NEW JERSEY AGRICULTURAL EXPERI-

MENT STATIONS

BULLETINS
326-335

1917-19

NEW BRUNSWICK, NEW JERSEY

CONTENTS

PRUNING EXPERIMENTS WITH PEACHES: RESULTS OF FIRST TWO SEASONS

NEW JERSEY

AGRICULTURAL

EXPERIMENT STATIONS

BULLETIN 326

(No. 1 of Pruning Series)

New Brunswick, N. J.

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CONTENTS

New Jersey Agricultural Experiment Stations

BULLETIN 326

MAY 23, 1917

Pruning Experiments with Peaches

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and

C. H. Connors, B.Sc.*

The problems of peach culture have been a feature of the investigational work of the horticultural department of the New Jersey Agricultural Experiment Station since 1906. By 1910 the pruning factor had presented itself as a matter that required further study for a full understanding of the relation of pruning to fertilization.

A vast amount of theory about pruning has been available for years, and it would be difficult to suggest any practice that would be entirely original and new. There has been a great lack of detailed and definite data, however, to establish the status of these various practices. The object of these pruning studies with peaches was to attempt to secure data of such a nature as to furnish a more definite basis for judging the effect and value of the common practices and principles of pruning peaches.

A thorough study of pruning would include a consideration of the following factors:

1. Effect of different forms of pruning upon the amount, form and character of the wood growth;

2. Effect of pruning during the growing season in comparison with pruning done during the dormant season;

* Credit is due Prof. A. J. Farley and Mr. G. B. Thrasher who planted both experiment orchards, and Mr. William Schieferstein and Mr. W. W. Oley, who assisted in securing records at various times during the first two seasons.

3. Effect of pruning upon the strength, hardiness and length of life of the trees;

4. Effect of pruning upon the position, amount, size, color, quality and time of maturity of the fruit;

5. Pruning as related to the cost of spraying, thinning and picking the fruit, removal of borers, and other details of orchard management.

It would not be possible to test every variation in pruning practice in a detailed manner, but the work is outlined in such a way as to include the more general practices.

TYPES OF PRUNING STUDIED

The project was planned to compare five general forms, or systems, of pruning:

1. *Not pruned,* in which the trees are allowed to develop according to their natural habit, the only wood removed being such twigs as may have died or branches that may have been broken by accident;

2. *Winter-pruned but not cut back,* in which system the tree is allowed to assume its natural habit, but during the dormant season all dead twigs and interfering and crossed branches and twigs are removed, and a little thinning of the top is to be practiced to prevent the formation of weak crotches and to admit sufficient light for the coloring of the fruit;

3. *Winter-pruned and cut back,* in which the same system of pruning as in (2) is practiced, but, in addition, the leading branches and twigs are cut back from one-third to one-half of the previous season's growth;

4. *Winter and summer-pruned,* in which the treatment is the same as in (3) except that any suckers or undesirable shoots are removed during the growing season, and that all leading shoots are pinched back during June or July to encourage a compact growth of the tree;

5. *Summer-pruned only,* in which all pruning is done during the growing season, the type of pruning being similar to (3).

Treatments 2 and 3 are the systems commonly used in commercial practice. The amount or severity of the pruning varies greatly with different growers, and it would vary with different

investigators. In these experiments, detailed records are kept of the actual amount of the growth pruned off, in an attempt to make this factor more definite.

VARIETIES CHOSEN FOR THE EXPERIMENT

In any pruning experiment the variety factor would need to be considered from three standpoints: the habit of growth of the variety, its season of ripening and its commercial value. Peach varieties vary considerably in their habit of growth, and at least three distinct types may be recognized:

1. A free, spreading, open habit like Carman and Belle;
2. A compact spreading habit like Elberta;
3. An upright habit with numerous twigs and branches like Stump, Mountain Rose and Early Crawford.

Some distinct variations from these types occur but they are not represented in any great quantity from the commercial standpoint. Carman was selected to represent the spreading type, since it is very widely grown commercially, and its season of ripening is early. Elberta is almost a distinct type in itself and the most widely grown variety. Stump is a well-known variety of the third type. It produces more twigs than such sorts as Carman and Belle, and is comparatively late in ripening, as it follows Elberta.

LOCATION AND ESTABLISHMENT OF EXPERIMENT ORCHARDS

Vineland Experiments

The principal experiment was located at the grounds of the Training School at Vineland, N. J., upon a piece of land adjoining the fertilizer plots which were planted in 1907 and 1908. The sandy loam soils and the climate in this section are ideal for the peach, and the trees grow rapidly, reach a large size, and come into bearing early. The soil upon the experimental area varies from a medium sandy to a gravelly loam. Previous to 1912 this plot of land was used for the growing of corn and truck crops, and was in a good state of cultivation.

The experiment was planned to comprise 10 plots of 15 trees, 5 trees each of the varieties Stump, Carman and Elberta being

represented. The trees were set 20 x 25 feet apart in April, 1912. Trees 1, 3 and 5 in each row were planted by the common furrow and hand method. Trees 2 and 4 in each row were plantetd in holes blown by ½ stick of 20 per cent dynamite exploded 18 inches below the surface of the ground.

The quality of the trees was much below the standard desired and ordered, but it was too late in the season to procure another lot and they were finally planted. They were all less than ½ inch in caliper and some did not exceed ¼ inch. All were cut back to a height of 18 inches when set.

The trees received fertilization and good culture during the growing season and no summer pruning was practiced the first year.

New Brunswick Experiments

A duplicate experiment with a smaller number of trees was started at the College Farm, New Brunswick, N. J. The site is somewhat elevated and the soil is a gravelly Penn loam (red shale) which had received good culture for a few years previous to the planting of the orchard. Peach trees grow to a large size in this locality but do not develop or come into bearing as early as they do at Vineland. The varieties chosen for this experiment were the same as at Vineland. The number of plots was limited to nine, however, and the number of trees in each plot consists of 3 Elberta, 2 Stump and 3 Carman.

The dynamiting experiment also was duplicated and Trees 2, 4, 6 and 8 in each row were planted by the furrow and hand method, while Trees 1, 3, 5 and 7 were planted by the use of dynamite, as previously described.

These trees were similar in quality to those planted at Vineland and received fertilization and good culture during the growing season. Here, as at Vineland, no summer pruning was attempted during the first season.

TWIG GROWTH MADE BY THE TREES AT VINELAND DURING 1912

In order to secure an accurate record of the vigor of each and all of the trees in the experiments, measurements in linear inches

were taken of the twig growth made by each tree during the season of 1912. Table 1 gives these results. In all tabulations fractions of less than 0.5 are disregarded, while fractions amounting to 0.5 and over are added as units. In all tables of summaries, Trees 1 in each row is omitted from the calculations. All percentages and averages are computed from totals and are never averages of averages.

TABLE I

MEASUREMENT OF TWIG GROWTH
VINELAND, 1912

PRUNING TREATMENT	Row	Variety	Tree 1	Tree 2	Tree 3	Tree 4	Tree 5	Average
			Inches	Inches	Inches	Inches	Inches	Inches
Not pruned	1	Stump,	491	545	273	860	767	611
	2	Carman,	...	643	890	800	734	767
	3	Elberta,	218	504	967	...	...	736
Winter not cut back	4	Stump,	...	563	636	900	774	718
	5	Carman,	528	969	408	969	842	797
	6	Elberta,	...	321	431	734	648	534
Summer only	7	Stump,	...	...	817	855	711	794
	8	Carman,	...	734	616	1068	1096	879
	9	Elberta,	232	749	774	681	478	671
Winter and summer	10	Stump,	507	1065	580	1254	777	919
	11	Carman,	441	731	585	839	767	731
	12	Elberta,	201	...	...	685	633	659
Winter cut back	13	Stump,	448	707	648	563	827	686
	14	Carman,	...	...	485	692	548	575
	15	Elberta,	99	571	439	669	419	525
Winter not cut back	16	Stump,	424	863	640	1010	930	861
	17	Carman,	...	1080	369	579	306	584
	18	Elberta,	324	679	578	...	542	600
Not pruned	19	Stump,	600	773	505	817	662	689
	20	Carman,	261	740	327	1177	860	776
	21	Elberta,	585	619	454	...	721	598
Winter and summer	22	Stump,	633	1078	504	726	777	771
	23	Carman,	...	927	628	657	643	714
	24	Elberta,	393	1201	973	713	630	879
Winter cut back	25	Stump,	470	971	963	1392	841	1042
	26	Carman,	393	895	941	1174	685	934
	27	Elberta,	542	806	621	659	1509	899
Summer only	28	Stump,	572	910	708	1202	909	932
	29	Carman,	255	1053	270	733	802	715
	30	Elberta,	265	743	548	584	725	650

With a few exceptions the trees made a good growth during the season of 1912. Trees 1 in all rows, planted along a former line between two farms, were more or less irregular and are not considered in the averages. In addition, the following

trees either died or were so lacking in vigor that they had to be replanted: Row 3, Trees 4 and 5; Row 7, Tree 2; Row 12, Trees 2 and 3; Row 14, Tree 2; Row 18, Tree 4; Row 21, Tree 4, a total of 8 trees out of 150.

It may be noted from the results in table 1 that the trees made a somewhat better growth at the west end of the orchard than at the east end, and that Plot 5 made the poorest average growth.

The average total linear twig growth in inches for all varieties was 746. The Stump made the greatest total growth of the three varieties, averaging 800 inches. Carman was second with an average of 750 inches and Elberta was third with an average of 677 inches. These are fairly good averages for the number of trees, the varieties concerned and the region in which they were planted. A somewhat larger growth might have been obtained with better stock.

Stump, Row 25, Tree 4, made the largest amount of growth for that variety with a total of 1392 inches. Stump, Row 1, Tree 3, was the poorest, making a total of only 273 inches. Nineteen Stump trees made a growth above the average, and 20 made growth that was below the average for that variety.

Of the Carman trees, Row 20, Tree 4 made the best growth, with a total of 1177 inches, and Row 29, Tree 3 made the poorest growth, with a total of 270 inches. This is the poorest tree that is considered in the averages. There were 17 trees above and 22 below the average for the variety.

Of the Elberta trees, Row 27, Tree 5 was the largest for the variety and for the entire orchard, with a total of 1509 inches. Row 6, Tree 2 was the smallest Elberta with a total growth of 321 inches. There were 14 above and 20 below the average for the variety.

Growth by Plots Arranged According to Future Treatments

The arrangement of the pruning treatments as to plots was not made until after the measurements of growth were taken and computed. An attempt was then made to locate the treatments so that any soil variations would be checked. They were assigned as follows:

Plots 1 and 7, Not pruned.
Plots 2 and 6, Winter-pruned, not cut back.
Plots 3 and 10, Summer-pruned only.
Plots 4 and 8, Winter- and summer-pruned.
Plots 5 and 9, Winter-pruned and cut back.

TABLE 2

GROWTH OF PLOTS ACCORDING TO FUTURE TREATMENTS
VINELAND, 1912

Treatment	Not Pruned			Winter Not Cut Back			Summer			Winter and Summer			Winter Cut Back			All	
Variety	Plot	Number Trees	Average Per Tree	Plot	Number Trees	Average Per Tree	Plot	Number Trees	Average Per Tree	Plot	Number Trees	Average Per Tree	Plot	Number Trees	Tree Average Per	Number Trees	Average Per Tree
			Inches			Inches			Inches			Inches			Inches		Inches
All, ...	1	10	698	2	12	681	3	11	780	4	10	792	5	11	597		
	7	11	696	6	11	689	10	12	765	8	12	788	9	12	955		
Totals,		21	697		23	686		23	772		22	790		23	784	112	746
Stump, ..	1	4	611	2	4	718	3	3	794	4	4	919	5	4	686		
	7	4	689	6	4	861	10	4	932	8	4	771	9	4	1042		
Totals,		8	650		8	790		7	873		8	845		8	864	39	800
Carman,	1	4	767	2	4	797	3	4	879	4	4	731	5	3	575		
	7	4	776	6	4	584	10	4	715	8	4	714	9	4	924		
Totals,		8	771		8	690		8	796		8	722		7	774	39	750
Elberta,	1	2	736	2	4	534	3	4	671	4	2	659	5	4	525		
	7	3	598	6	3	600	10	4	650	8	4	880	9	4	899		
Totals,		5	653		7	562		8	660		6	806		8	712	34	677

Table 2 shows the comparative vigor of the trees at the close of the season of 1912, as assigned to the various treatments. The treatments rank in the following order, all three varieties being considered:

		Av. growth per tree (in.)
1.	Winter and summer, ...	790
2.	Winter cut back, ...	784
3.	Summer only, ...	772
4.	Not pruned, ...	697
5.	Winter not cut back, ...	686

The treatments take somewhat different rank where each variety is considered separately. The "not pruned" treatment ranks third in the case of Carman, and fourth and fifth in the case of Elberta and Stump, respectively. The "winter and not cut back" treatment ranks last in the case of Carman and Elberta. These variations according to variety will receive attention as the experiment proceeds.

MEASUREMENT OF CIRCUMFERENCE AT VINELAND

It was thought that the measurement of the total linear twig growth of each tree in the experiments would become too great a task after a time, and that it would be well to study the relation between the rate of increase in the girth of the trunk and the amount of twig growth. The trees when received from the nursery varied considerably as to caliper, and differences were still apparent at the end of the first season's growth, as is shown in table 3. This table gives the circumference, in inches, of each tree, taken about six inches from the ground. It will be noted that the following trees had trunks that branched at or below that point: Row 1, Trees 1 and 3; Row 3, Trees 1, 2 and 3; Row 8, Tree 4; Row 16, Tree 2; Row 18, Tree 2; Row 19, Tree 2; Row 20, Trees 2 and 3; Row 21, Trees 2 and 5; Row 24, Tree 3; Row 27, Tree 1; Row 30, Trees 2 and 3.

In computing the averages, Tree 1 in each row is not considered, following the same plan as in tabulating the amount of twig growth.

Row 8, Tree 5 (Carman), had the largest girth for all varieties at the end of 1912, measuring 5.25 inches. The smallest girth measured was that of Row 8, Tree 2 (Carman), 2.12 inches. The average for all the trees of all varieties was 3.95 inches. 48 being above the average and 50 below.

Stump had the greatest average girth of the three varieties compared, with an average measurement of 4.17 inches. Eighteen were above average and 18 below. Row 10, Tree 4 had the largest girth of any Stump, with a measurement of 5.12 inches, while Row 28, Tree 2 had the smallest, 3.12 inches.

Carman had the largest tree as to trunk circumference and also the smallest tree, noted above. The average girth for the variety was 3.92 inches, 19 being above the average and 17 below.

TABLE 3

MEASUREMENT OF CIRCUMFERENCES
VINELAND, 1912

PRUNING TREATMENT	Row	Variety	*Tree 1	Tree 2	Tree 3	Tree 4	Tree 5	Average
			Inches	Inches	Inches	Inches	Inches	Inches
Not pruned	1	Stump, ...	Br.	3.37	Br.	5.00	4.25	4.21
	2	Carman, ...	....	4.25	4.12	3.50	4.75	4.16
	3	Elberta, ...	Br.	Br.	Br.	....	....	....
Winter not cut back	4	Stump, ...	....	3.50	4.00	4.75	4.37	4.16
	5	Carman, ...	3.25	3.36	3.25	3.37	4.37	3.59
	6	Elberta, ...	....	3.62	3.66	3.75	4.00	3.76
Summer only	7	Stump, ...	....	....	4.25	3.88	4.88	4.34
	8	Carman, ...	....	2.12	4.25	Br.	5.25	3.87
	9	Elberta, ...	2.50	3.75	3.25	4.25	3.75	3.75
Winter and summer	10	Stump, ...	3.50	3.75	4.00	5.12	4.50	4.34
	11	Carman, ...	3.25	3.75	3.88	3.75	4.62	4.00
	12	Elberta, ...	2.50	....	....	3.12	3.62	3.37
Winter cut back	13	Stump, ...	3.00	3.62	4.00	3.75	4.62	4.00
	14	Carman, ...	....	....	3.88	3.12	3.62	3.54
	15	Elberta, ...	....	2.50	3.88	3.37	3.50	3.31
Winter not cut back	16	Stump, ...	2.75	Br.	3.75	4.75	4.75	4.42
	17	Carman, ...	....	4.12	3.36	4.00	3.37	3.95
	18	Elberta, ...	2.12	Br.	2.88	....	5.12	4.00
Not pruned	19	Stump, ...	2.88	Br.	3.88	4.00	4.50	4.13
	20	Carman, ...	2.00	Br.	Br.	4.37	5.00	4.69
	21	Elberta, ...	3.00	Br.	3.00	....	Br.	3.00
Winter and summer	22	Stump, ...	2.62	4.88	3.88	4.25	4.25	4.32
	23	Carman, ...	....	4.00	3.50	3.62	4.00	3.78
	24	Elberta, ...	3.12	3.75	Br.	3.50	4.37	3.87
Winter cut back	25	Stump, ...	3.00	4.25	3.88	4.37	4.37	4.22
	26	Carman, ...	3.12	4.88	3.50	4.75	4.12	4.31
	27	Elberta, ...	Br.	3.75	3.25	4.12	5.00	4.03
Summer only	28	Stump, ...	2.75	3.12	3.75	3.88	4.12	3.72
	29	Carman, ...	2.62	4.12	2.75	4.25	4.37	3.87
	30	Elberta, ...	2.12	Br.	Br.	3.36	3.75	3.56

* Tree 1 of each row is not included in average.

Elberta had the smallest average circumference, the average being 3.69 inches. Thirteen trees were above average and 13 below. Row 18, Tree 5 had the largest girth for the variety, measuring 5.12 inches. Row 15, Tree 2 was the smallest with a circumference of 2.50 inches. It will be noted that in the case of Elberta in the "not pruned" treatment there is only one tree that can be considered in the averages as to circumference.

Measurement of Circumference Arranged According to Future Treatments

Table 4 shows the average circumferences as they would affect the future pruning treatment of the different plots. The rank of the various treatments, all varieties being considered, is as follows:

	Average circumference Inches
1. Not pruned, ...	4.15
2. Winter- and summer-pruned, ...	4.01
3. Winter cut back, ...	3.92
4. Winter not cut back, ...	3.91
5. Summer, ...	3.85

TABLE 4

MEASUREMENT OF CIRCUMFERENCES IN PLOTS ACCORDING TO FUTURE TREATMENTS

VINELAND, 1912

Treatment	Unpruned			Winter Not Cut Back			Summer			Winter and Summer			Winter Cut Back			All	
Variety	Plot	Number Trees	Average Per Tree	Plot	Number Trees	Average Per Tree	Plot	Number Trees	Average Per Tree	Plot	Number Trees	Average Per Tree	Plot	Number Trees	Average Per Tree	Number Trees	Average Per Tree
			Inches			Inches			Inches			Inches			Inches		Inches
All, ...	1	7	4.18	2	12	3.83	3	10	3.96	4	10	4.01	5	11	3.62		
	7	6	4.13	6	9	4.01	10	10	3.75	8	11	4.00	9	12	4.19		
Totals,		13	4.15		21	3.91		20	3.85		21	4.01		23	3.92	98	3.95
Stump, ..	1	3	4.21	2	4	4.16	3	3	4.34	4	4	4.34	5	4	4.00		
	7	3	4.13	6	3	4.42	10	4	3.72	8	4	4.32	9	4	4.22		
Totals,		6	4.17		7	4.27		7	3.98		8	4.33		8	4.11	36	4.17
Carman,	1	4	4.16	2	4	3.59	3	3	3.87	4	4	4.00	5	3	3.54		
	7	2	4.69	6	4	3.95	10	4	3.87	8	4	3.78	9	4	4.31		
Totals,		6	4.33		8	3.65		7	3.87		8	3.89		7	3.98	36	3.92
Elberta,	1	..	....	2	4	3.76	3	4	3.75	4	2	3.37	5	4	3.31		
	7	1	3.00	6	2	4.00	10	2	3.56	8	3	3.87	9	4	4.03		
Totals,		1	3.00		6	3.84		6	3.69		5	3.67		8	3.67	26	3.69

The difference between the highest and the lowest is only 0.30 inch, which means a difference of less than $^3/_{32}$ inch in the diameter. It will be noted that the trees of the "not pruned" treatment show the largest average circumference, yet these trees rank fourth in average twig growth. The fact that only 13 trees of this treatment are averaged as to circumference of trunks, and also that they branch close to the ground, probably accounts for the result.

The rank of treatments by varieties is as follows:

	Average circumference Inches
Stump—	
1. Winter and summer,	4.33
2. Winter not cut back,	4.27
3. Not pruned,	4.17
4. Winter cut back,	4.11
5. Summer,	3.98
Carman—	
1. Not pruned,	4.33
2. Winter cut back,	3.98
3. Winter and summer,	3.89
4. Summer,	3.87
5. Winter not cut back,	3.65
Elberta—	
1. Winter not cut back,	3.84
2. Summer,	3.69
3. Winter cut back,	3.67
4. Winter and summer,	3.67
5. Not pruned,	3.00

The averages for the various treatments are fairly uniform. The maximum difference in average circumference between the different pruning treatments of the variety Stump is 0.28 inch, or a little less than $^3/_{32}$ inch in diameter. For Carman this difference is 0.68 inch, or $^7/_{32}$ inch difference in diameter; and for Elberta, 0.84 inch, or $^{17}/_{64}$ inch in diameter.

EFFECT OF DYNAMITING THE SOIL PREVIOUS TO THE PLANTING OF THE TREES

The dynamiting experiment was a special study planned and conducted by Mr. Arthur J. Farley, and reports upon the results

of this test have been made by him from time to time.[1] The results will be considered in this discussion only in so far as they may relate to the pruning work. This refers to the experiments at both Vineland and New Brunswick.

MEASUREMENT OF TWIG GROWTH AT NEW BRUNSWICK, 1912

Measurements were made of the twig growth of the trees at the College Farm at the close of the first growing season, and the results are given in table 5. The amount of growth made

TABLE 5

MEASUREMENTS OF TWIG GROWTH
NEW BRUNSWICK, 1912

VARIETY	Tree	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	Row 9	All Rows
		NP	WNCB	W & S	S	WCB	W & S	S	WNCB	WCB	
		Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
Elberta, ...	1	341	246	433	206	162	108	330	338	261	
	2	750	400	250	333	627	633	267	493	528	
	3	620	132	186	119	262	444	338	797	156	
	4	...	427	...	...	...	...	...	...	...	
Average, ...	..	570	301	290	219	350	395	312	543	315	364
Stump, ...	4	625	...	757	418	747	924	649	653	1239	
	5	490	486	314	353	606	812	463	484	324	
Average, ...	..	558	486	536	386	677	868	556	569	782	609
Carman, ...	6	...	108	427	438	519	318	998	484	295	
	7	170	190	160	532	214	324	508	624	306	
	8	474	314	334	528	334	270	310	540	680	
Average, ...	..	322	204	307	499	356	304	605	550	427	400
All Average, ...	..	496	288	358	366	434	479	483	552	474	436

Note.—In this and succeeding tables NP represents "Not Pruned"; WNCB, "Winter Not Cut Back"; W & S "Winter and Summer"; S, "Summer Only"; WCB, "Winter Cut Back."

by the trees may be said to be fair to good for the locality, the average for all varieties being 436 inches. The growth at New Brunswick, however, is considerably below that made at Vineland, the average difference being 311 inches. This would be equivalent to 31 branches 10 inches long or about 26 branches

[1] Some results of dynamiting for tree planting. In N. J. Agr. Exp. Sta. 34th Ann. Rept., 1913, p. 120–129. Planting trees with dynamite. In Proc. N. J .State Hort. Soc., 1913.

12 inches long. All of the trees lived, and although the amount of linear twig growth in a few cases was small, all were allowed to remain and none were replanted at the close of the first season.

The growth considered by rows was fairly uniform, except in Rows 2, 3 and 4.

There was some variation in growth according to variety. Stump made the largest average growth, with 609 inches. Carman was second with an average of 400 inches, and Elberta third with an average of 364 inches. This is the same relative behavior of the varieties as occurred at Vineland.

A consideration of the individual trees of the three varieties shows the following result. The largest Stump tree was Row 9, Tree 4, with a total linear twig growth of 1239 inches; and the smallest, Tree 5 in Row 3, with a total growth of 314 inches. Eight trees were above and 9 below the average of 609 inches.

The largest Carman tree was Row 7, Tree 6. This tree made a total twig growth of 998 inches. The smallest Carman tree was Row 2, Tree 6, with a total twig growth of 108 inches. Twelve Carman trees were above and 14 below the average of 400 inches.

The largest Elberta tree was Row 8, Tree 3, with a total linear twig growth of 797 inches; the smallest was Row 6, Tree 1, with a total of 108 inches. Eleven Elberta trees were above the average twig growth of 364 inches, and 17 were below.

Growth by Plots Arranged According to Future Treatments

Following the plan adopted at Vineland, after the measurements of twig growth were computed for the first season, the rows for the different treatments were selected. This was done in such a way as to have the average for the various treatments as uniform as possible. The rows assigned to the various treatments were as follows:

Row 1,	Not pruned.
Rows 2 and 8,	Winter not cut back.
Rows 3 and 6,	Winter and summer.
Rows 4 and 7,	Summer only.
Rows 5 and 9,	Winter cut back.

It was not possible to have more than one row for the "not pruned" treatment, and the selection of an outside row is a little unfortunate, since there is a considerable cultivated area beyond it. These conditions should favor this row, since there is no chance of its being restricted in growth by lack of moisture or light as a result of the near presence of another row of trees.

In Row 2 (see table 5) it will be noted that Tree 4 proved to be an Elberta and not a Stump.

Table 6 shows the average total linear twig growth of the various rows as selected for the treatments.

TABLE 6

GROWTH BY PLOTS ACCORDING TO FUTURE TREATMENTS

NEW BRUNSWICK, 1912

VARIETY	TREATMENT					
	Not Pruned	Winter Not Cut Back	Winter Cut Back	Winter and Summer	Summer	All
	Inches	Inches	Inches	Inches	Inches	Inches
Elberta,	570	472	333	342	266	364
Stump,	558	541	729	702	471	609
Carman,	322	452	391	306	552	400
All,	496	480	454	418	424	436

When all varieties are considered the ranking upon this basis is as follows:

		Inches
1.	Not pruned,	496
2.	Winter not cut back,	480
3.	Winter cut back,	454
4.	Summer only,	424
5.	Winter and summer,	418

Separate rankings according to varieties vary from the ranking for all varieties. The "not pruned" treatment is first with Elberta, but third and fifth with Stump and Carman, respectively. The "winter not cut back" treatment is second in the case of Elberta and Carman, but fourth with Stump. "Winter cut back" is the first in rank with Stump, but third with Carman and fourth with Elberta. The "winter and summer" treatment is

second, third and fourth with Stump, Elberta and Carman, respectively. The "summer only" treatment ranks first with Carman, but fifth with both Elberta and Stump. This varietal difference may need to be considered in the future performances of the trees. It should be noted that this is the rank of the treatments just previous to the beginning of the actual pruning work.

MEASUREMENT OF CIRCUMFERENCE AT NEW BRUNSWICK, 1912

The girth of the trees in the experiments at the College Farm also were taken, and the results appear in table 7. The following trees were branched at the ground and were not considered in the averages:

Row 1, Trees 1, 3, 5; Row 2, Tree 5; Row 3, Tree 4; Row 6, Tree 4; Row 8, Tree 8.

TABLE 7

MEASUREMENTS OF CIRCUMFERENCES

NEW BRUNSWICK, 1912

VARIETY	Tree	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	Row 9	All Rows
		NP	WNCB	W & S	S	WCB	W & S	S	WNCB	WCB	All Treatments
		Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
Elberta,	1	...	3.31	3.37	3.50	3.75	3.81	3.75	4.31	3.87	
	2	3.12	2.93	2.81	2.81	2.43	3.75	2.00	2.00	2.18	
	3	...	2.18	3.00	3.12	3.06	2.81	2.93	3.37	3.18	
	4	...	3.12	...	...	...	...	...	...	...	
Average,	..	3.12	2.89	3.06	3.14	3.08	3.46	2.89	3.23	3.08	3.10
Stump,	4	3.93	....	...	2.93	3.81	...	3.50	3.37	3.37	
	5	...	....	3.25	3.81	4.00	2.93	3.18	4.00	4.00	
Average,	..	3.93	....	3.25	3.37	3.91	2.93	3.34	3.69	3.69	3.54
Carman	6	4.00	2.50	2.68	2.56	3.68	3.37	3.12	4.31	2.56	
	7	4.68	3.18	2.00	3.12	3.93	3.00	3.00	3.18	3.62	
	8	3.75	3.00	3.00	2.93	2.87	2.62	3.50	....	2.75	
Average,	..	4.14	2.89	2.56	2.87	3.49	3.00	3.21	3.75	2.98	3.19
All Average,	..	3.90	2.89	2.87	3.10	3.44	3.18	3.12	3.51	3.19	3.22

The average circumference of all the trees was 3.22 inches, which is 0.73 inches below the average of the Vineland trees.

The largest tree was Row 1, Tree 7 (Carman), with a girth of 4.68 inches. Three are tied in rank as to smallest circumference, Row 3, Tree 7 (Carman); Row 7, Tree 2 (Elberta), and Row 8, Tree 2 (Elberta), with a circumference of 2 inches. The Carman variety had the poorest tree at both Vineland and New Brunswick. This was undoubtedly due to the poor quality of the trees when purchased, since Carman is in general a more vigorous grower than Elberta.

TABLE 8

AVERAGE CIRCUMFERENCES ACCORDING TO FUTURE TREATMENTS
NEW BRUNSWICK, 1912

VARIETY	TREATMENT					
	Not Pruned	Winter Not Cut Back	Winter Cut Back	Winter and Summer	Summer	All
	Inches	Inches	Inches	Inches	Inches	Inches
Elberta,	3.12	3.54	3.08	3.26	3.02	3.10
Stump,	3.93	3.69	3.80	3.09	3.36	3.54
Carman,	4.14	3.29	3.24	2.78	3.04	3.19
All,	3.90	3.44	3.32	3.03	3.11	3.22

The average girth of the Stump trees was 3.54 inches, the highest for the three varieties. The largest Stump trees are Trees 5 in Rows 5, 8 and 9, with girths of 4.00 inches, and the smallest circumference occurred with Row 4, Tree 4, and Row 6, Tree 5, which made circumferences of 2.93 inches.

The average girth of the Carman trees was 3.19 inches, which is the poorest average for the three varieties. The largest Carman was Row 1, Tree 7, with a girth of 4.68 inches, and this is the largest tree of all the varieties. Row 3, Tree 7 measured 2.00 inches in circumference.

The average girth of the Elberta trees was 3.10 inches. The largest was Row 8, Tree 1, with a girth of 4.31 inches; Row 7, Tree 2, and Row 8, Tree 2, were smallest with a circumference of 2 inches.

It is of interest to note that the trees which were the largest and the smallest in circumference were not identical with the trees making the largest and the smallest amounts of twig growth, respectively. After the future pruning treatments had been

assigned, it was found that the rank according to average circumference considering all varieties was as follows:

	Average circumference Inches
1. Not pruned,	3.90
2. Winter not cut back,	3.44
3. Winter cut back,	3.32
4. Summer only,	3.11
5. Winter and summer,	3.03

This is the same ranking as in the case of average linear twig growth (page 18). The ranking of the different varieties, however, varies from the general average, as may be noted in table 8.

PRUNING OF THE TREES FOLLOWING THE FIRST SEASON'S GROWTH

The real work of pruning did not begin until the dormant season following the first summer's growth. A discussion of pruning from the standpoint of the mechanical strength of various branch formations, the actual form of the tree and the varying of a treatment to meet the requirements of individual trees and special conditions may appropriately be deferred until a later period in the progress of the experiments. A mere outline of the system of pruning in the various treatments is given at this time.

Attention should be called to the fact that since dormant season pruning may be done in December of one year or carried on into January, February or March of the next year, the statement that such a tree was pruned in 1913, for example, might lead to confusion as to whether it was really pruned in January, 1913, or December, 1913, which would mean a difference of a season in the age of the trees. To avoid any possibility of a doubt, the two years covering a dormant season will be noted. For example, the first summer's growth closed in September, 1912, the first dormant pruning will be noted as that of 1912–1913 and the second dormant pruning will appear as that of 1913–1914.

Photographs have been taken of a considerable number of trees since the beginning of the experiments to show the appearance of the trees before and after pruning each season. Only a few trees are selected for illustration at this time, and the photographs recording the growth of two seasons of each individual

tree are shown on the same page for a better comparison. A photograph does not portray accurately the form and spread of the branches of a tree, since it tends to give the effect that all branches are in the same plane; and a top may appear rather congested in growth when in fact it is well spread.

The "not pruned" trees were not cut or treated in any way except for the removal of a few suckers which developed below the bud. Figure 1 illustrates Stump, Row 10, Tree 2, at Vineland at the close of the first season's growth, and figure 3 illustrates Carman, Row 20, Tree 4.

Upon all the other plots an attempt was made to have several forms of trees represented. Where a tree naturally formed a head 6 inches from the ground it was allowed to do so, and trees which naturally formed heads at 12, 18 or 24 inches were not greatly modified. Since individual records are kept in these experiments, such a practice offers more opportunities for the study of pruning than would be the case if an attempt was made to develop the heads at a uniform height.

In a general way the trees in the "winter pruned and not cut back" treatment were pruned as follows: Three or four well placed branches were selected, whenever possible, to form the main or scaffold framework of each tree. All small side branches lower than 18 inches from the ground were pruned off. Where the side branches were too numerous through the top of the tree they were thinned out. An attempt was made to have this pruning quite similar to that generally followed in some parts of central and northern New Jersey and elsewhere.

Figures 5 and 6 illustrate Carman, Row 17, Tree 2, at Vineland before and after pruning in 1912–1913. Figures 9 and 10 illustrate Elberta, Row 18, Tree 5, before and after pruning in 1912–1913. This is an example of a compact, well spread tree which requires but little corrective pruning. Figures 13 and 14 illustrate Stump, Row 16, Tree 3, from which a considerable amount of twig growth was removed from the lower part of the trunk.

The "winter cut back" treatment follows the preceding plan so far as the selection of the scaffold branches and the removal of small side branches below 18 inches from the ground is concerned. In addition, however, all side and main branches were

cut back slightly, preferably just above an outside branch. The object is to make the tree spread to keep the top relatively low, and to keep the center of the tree open. Cutting back the branches tends also to stiffen the framework of the tree.

Figures 17 and 18 show Stump, Row 25, Tree 3, before and after pruning. Two or three relatively large side branches were removed because they were below 18 inches from the ground.

A Carman tree, Row 14, Tree 5, is illustrated before and after pruning in 1912–1913, in figures 21 and 22. The tree was thinned by removing a number of twigs and the remainder were cut back.

The "winter and summer" and the "summer only" treatments were pruned in the same fashion as the "winter cut back" at this stage. They later received pruning during the growing season.

Stump, Row 10, Tree 4 (fig. 25 and 26), is selected as one illustration of the pruning of a tree in this treatment. Two Elberta trees also are selected to illustrate the pruning in this treatment, since one, Row 12, Tree 4 (fig. 31 and 32) was pruned so as to form a single short trunk, while Row 24, Tree 3 (fig. 37 and 38) was pruned so as to allow three scaffold branches to form a few inches from the ground. Quite similar individuals occur in the other treatments, so that observations are being made with both types of trees, as previously noted.

To illustrate the pruning in the "summer only" treatment, Carman, Row 8, Tree 4, at Vineland was selected (fig. 43 and 44), and also Elberta, Row 4, Tree 3 (fig. 50 and 51), at New Brunswick. The latter tree had started growth slightly before all the measurements and photographs could be secured.

SUMMER PRUNING AT VINELAND DURING 1913

The summer pruning in 1913 consisted of the removal of all suckers or shoots below 18 inches on the trunk, and any that tended to make the center of the tree too dense. This pruning was done about the middle of June and the leading branches were also "tipped" at this time to encourage the development of side branches.

The trees in the plots to receive summer pruning *only* were pruned a second time in September when growth had about

ceased. This pruning consisted of a thinning out and a cutting back similar to the "winter pruned and cut back" treatment except that it was done in the fall. Measurements were made in linear inches of twig growth removed at each summer pruning, and the results appear in table 9.

TABLE 9.

GROWTH REMOVED IN SUMMER PRUNING

VINELAND, 1913

	SUMMER Plot 3			WINTER AND SUMMER Plot 4			WINTER AND SUMMER Plot 8			SUMMER Plot 10		
	Stump	Carman	Elberta	Stump	Carman	Elberta	Stump	Carman	Elberta	Stump	Carman	Elberta
Row	7	8	9	10	11	12	22	23	24	28	29	30
Tree	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
1	....	1144	1055	1127	1042	902	524	....	1458	1553	1396	896
2	....	1101	2680	1276	984	....	1341	1464	1823	2636	3469	3132
3	1324	1197	1243	733	488	....	855	1056	936	2590	1878	1247
4	1105	2314	1333	1347	689	860	1524	933	1069	2935	1880	1528
5	1817	2888	1186	1060	835	1182	1338	1555	1079	2194	1810	1575
Average,	1432	1875	1611	1104	749	1021	1265	1502	1227	2589	2249	1871
		1658			945			1331			2238	

In the "summer pruned only" treatment an average of 2093 inches was removed from the Stump trees, 2067 inches from the Carman and 1741 from the Elberta. In the "summer and winter" treatment only, the June summer pruning was practiced and an average of 1184 inches was removed from each Stump tree, 1126 inches from Carman and 1158 inches from Elberta.

The average amount of growth removed per tree per plot in the "summer only" treatment was 1658 inches on Plot 3 and 2238 inches on Plot 10, or a general average of 1961 inches.

The average amount of growth removed per tree per plot in the summer pruning of the "winter and summer" treatment was 945 inches on Plot 4 and 1331 inches on Plot 8, or a general average of 1156 inches.

SUMMER PRUNING AT NEW BRUNSWICK DURING 1913

The summer pruning at New Brunswick was similar to the work at Vineland, and a tabulation of the linear inches of twig growth removed is shown in table 10.

TABLE 10

GROWTH REMOVED IN SUMMER PRUNING

NEW BRUNSWICK, 1913

TREATMENT VARIETY	Tree	Row 3 Winter and Summer	Row 4 Summer	Row 6 Winter and Summer	Row 7 Summer
		Inches	Inches	Inches	Inches
Elberta,	1	670	1046	430	907
	2	357	1235	654	1426
	3	436	1639	450	365
Average,	.....	488	1307	511	899
Stump,	4	705	1236	1101	779
	5	594	1559	406	681
Average,	.....	650	1398	502	730
Carman,	6	600	615	878	690
	7	339	1067	622	487
	8	346	1053	248	776
Average,	.....	428	912	583	651
All Average,	.....	506	1181	599	764

In the "summer only" treatment, an average of 1103 inches of growth was removed from the Elberta trees, 1064 from the Stump trees and 781 from the Carman trees. In the "summer and winter" treatments, the amounts of twig growth removed in June averaged 500 inches for Elberta, 702 inches for Stump and 506 inches for Carman.

The treatment average per tree for all varieties was 973 inches in the case of the "summer only" treatment and 552 inches in the case of the "summer and winter" treatment. The first average is 988 inches below the corresponding average for the Vineland trees and the second is 604 inches below.

ILLUSTRATIONS OF PRUNING IN SUMMER

Photographs were taken to show the character of the pruning in the summer of 1913.

The pruning of the "winter and summer" treatment, which was performed in June, 1913, is illustrated first by Stump, Row 10, Tree 4, at Vineland, shown in figures 27 and 28. In the case of this tree, the shoots were removed from the trunk and scaffold branches to a height of about 24 inches above the ground, and a considerable amount of thinning was done, the amount pruned off being 1347 inches. Elberta, Row 12, Tree 4, at Vineland, also is shown in figures 33 and 34. In this case also, the shoots were removed from the trunk to a height of about 24 inches, but the amount of thinning required was less, 860 inches being removed. The pruning of Elberta, Row 24, Tree 3, at Vineland, is illustrated in figures 39 and 40. Here 936 inches of twig growth were removed, the effect upon the top being quite perceptible.

Trees receiving the "summer only" treatment were pruned twice during the growing season. Figures 45 and 46 illustrate the appearance of a Carman tree, Row 8, Tree 4, at Vineland, before and after pruning in June, 1913. The same tree before and after pruning, in October, 1913, is shown in figures 47 and 48. The tree was about to lose its leaves at the time the latter pruning was performed. An Elberta tree, Row 4, Tree 3, at New Brunswick, before and after pruning in June, 1913, is shown in figures 52 and 53. The same tree before and after pruning in October, 1913, is shown in figures 54 and 55. On this tree also, the leaves were about to fall at the time of pruning.

TWIG GROWTH MADE DURING 1913 AT VINELAND

At the close of the season's growth in 1913, measurements were again made of the total linear twig growth. These results are given in table 11. The growth removed by summer pruning is, of course, included in the averages of total growth. The average growth of each tree, regardless of variety and treatment, was 3981 inches. There were 55 individual trees above this average and 55 below it.

The Stump made the greatest average growth of the three varieties under comparison with an average of 4258 inches. Carman was second with an average of 4026 inches, and Elberta was third with 3608 inches. There were 19 Stump trees above the average for the variety and 19 below; 19 Carman trees above the average for the variety and 20 below; and 14 Elberta trees above the average for the variety and 19 below.

TABLE II

MEASUREMENT OF TWIG GROWTH

VINELAND, 1913

PRUNING TREATMENT	Row	Variety	*Tree 1	Tree 2	Tree 3	Tree 4	Tree 5	Average
			Inches	Inches	Inches	Inches	Inches	Inches
Not pruned	1	Stump,	5172	3175	2302	5014	2827	3330
	2	Carman,	....	5728	2569	2627	1571	3124
	3	Elberta,	1808	4141	3002	....	....	3572
Winter not cut back	4	Stump,	....	4739	2110	....	3780	3543
	5	Carman,	3510	4721	2781	3775	3637	3729
	6	Elberta,	....	3076	1466	4208	2746	2874
Summer only	7	Stump,	....	....	2731	3623	3793	3382
	8	Carman,	2113	3547	2715	5543	5578	4346
	9	Elberta,	2295	4844	2233	3324	2396	3199
Winter and summer	10	Stump,	3912	4240	2832	6288	4026	4347
	11	Carman,	3862	4213	2653	4144	3825	3709
	12	Elberta,	1926	....	....	3481	3027	3254
Winter cut back	13	Stump,	2621	4925	3431	4586	4559	4375
	14	Carman,	....	....	3825	5137	2676	3879
	15	Elberta,	....	3343	2665	3956	2558	3131
Winter not cut back	16	Stump.	2947	4707	4960	5578	3737	4796
	17	Carman,	....	5060	2603	2499	1045	2802
	18	Elberta,	1611	4931	2315	....	2498	3248
Not pruned	19	Stump,	2489	5507	4267	5061	3682	4629
	20	Carman,	1652	5331	2929	5088	4515	4466
	21	Elberta,	....	5258	....	....	3249	4254
Winter and summer	22	Stump,	2808	5530	3428	4010	4177	4286
	23	Carman,	....	5410	3182	3539	3714	3961
	24	Elberta,	3410	4514	4235	4402	4166	4329
Winter cut back	25	Stump,	3825	4511	2964	7108	3618	4550
	26	Carman,	3307	6088	4189	5657	4592	5132
	27	Elberta,	3833	4819	1885	3350	5311	3841
Summer only	28	Stump,	3171	5046	4899	5233	4603	4945
	29	Carman,	3506	6883	3922	5480	4010	5074
	30	Elberta,	2409	6746	2810	3530	4570	4414

* Tree 1 in each row is not included in the averages for the rows.

The largest Stump tree in 1913 was Row 25, Tree 4, with a total of 7108 inches. This is also the largest tree of any variety. The poorest Stump tree was Row 4, Tree 3, with a total of 2110 inches.

The largest Carman tree was Row 29, Tree 2, with a total of 6883 inches, and the poorest Carman tree was Row 17, Tree 5, with a total of 1045 inches. This was also the smallest tree of the lot.

The largest Elberta was Row 30, Tree 2, with a total of 6746 inches, and the poorest, Row 6, Tree 3, with a total of 1466 inches.

It is of interest to note that only one tree of those mentioned as making either the greatest or the poorest growth for the variety in 1913 appeared in a similar list for 1912. The tree is Tree 4, Row 25, and is a Stump. All the trees in the experiment made an average gain over that of 1912 of 3243 inches, or 433 per cent. The Stump trees made an average gain in growth during 1913 of 3458 inches, the Carman trees 3277 inches, and the Elberta trees 2925 inches.

Growth by Plots Arranged According to Future Treatments

In table 12 is shown the average twig growth made by the trees according to future treatment.

TABLE 12

GROWTH OF PLOTS ACCORDING TO FUTURE TREATMENTS
VINELAND, 1913

	Not Pruned			Winter Not Cut Back			Summer			Winter and Summer			Winter Cut Back			All Treatments	
VARIETY	Plot	Number Trees	Average Per Tree	Plot	Number Trees	Average Per Tree	Plot	Number Trees	Average Per Tree	Plot	Number Trees	Average Per Tree	Plot	Number Trees	Average Per Tree	Number Trees	Average Per Tree
			Inches			Inches			Inches			Inches			Inches		Inches
All, ...	1	10	3296	2	11	3367	3	11	3666	4	10	3873	5	11	3787		
	7	10	4489	6	11	3649	10	12	4811	8	12	4192	9	12	4508		
		20	3892		22	3522		23	4263		22	4047		23	4168	110	3981
Stump, ..	1	4	3330	2	3	3543	3	3	3382	4	4	4347	5	4	4375		
	7	4	4630	6	4	4796	10	4	4945	8	4	4286	9	4	4550		
		8	3980		7	4259		7	4285		8	4316		8	4463	38	4258
Carman,	1	4	3124	2	4	3429	3	4	4346	4	4	3709	5	3	3876		
	7	4	4466	6	4	2802	10	4	5074	8	4	3961	9	4	5132		
		8	3795		8	3265		8	4710		8	3835		7	4595	39	4026
Elberta,	1	2	3572	2	4	2874	3	4	3199	4	2	3254	5	4	3131		
	7	2	4254	6	3	3248	10	4	4414	8	4	4329	9	4	3841		
		4	3913		7	3034		8	3807		6	3971		8	3486	33	3608

The rank of the various treatments in 1912 and 1913 is compared in table 13.

TABLE 13

GROWTH OF THE VARIOUS TREATMENTS FOR 1912 AND 1913 COMPARED ACCORDING TO RANK

VARIETY	All		Stump		Carman		Elberta	
TREATMENT	1912	1913	1912	1913	1912	1913	1912	1913
Not pruned,	4	4	5	5	3	4	4	2
Winter not cut back,	5	5	4	4	5	5	5	5
Winter cut back,	2	2	2	1	2	2	2	4
Winter and summer,	1	3	3	2	4	3	1	1
Summer,	3	1	1	3	1	1	3	3

It will be noted that where all varieties are considered the ranking is the same for both years, except that the placing of "winter and summer" and "summer" is reversed. The placing of the "winter not cut back" and the "not pruned" treatments of the variety Stump; of the "summer," "winter cut back," and "winter not cut back" treatments of the variety Carman; and of the "winter and summer," "summer" and "winter not cut back" treatments of the variety Elberta, is consistent.

Comparisons on Basis of Per Cent Gain in Twig Growth Over that of 1912

A comparison between trees or treatments upon the basis of total growth indicates the relative size of the trees, yet it may not correctly indicate the rate of growth made by these trees. A comparison upon the basis of per cent gain in growth during 1913 over that made in 1912 does this, however. While the varieties ranked: 1—Stump, 2—Carman and 3—Elberta, according to average total twig growth, the rank according to per cent gain in growth was: 1—Carman (437 per cent), 2—Stump (432 per cent), and 3—Elberta (428 per cent). The per cent gain in growth for each tree is given in table 14.

Table 14

Per Cent Gain in Twig Growth of Individual Trees at Vineland, 1913 Over 1912.

Plot	Row	Tree 2 Growth 1912	Tree 2 Growth 1913	Tree 2 Gain	Tree 3 Growth 1912	Tree 3 Growth 1913	Tree 3 Gain	Tree 4 Growth 1912	Tree 4 Growth 1913	Tree 4 Gain	Tree 5 Growth 1912	Tree 5 Growth 1913	Tree 5 Gain	Average Growth 1912	Average Growth 1913	Average Gain*
		Inches	Inches	Per cent	Inches	Inches	Per cent	Inches	Inches	Per cent	Inches	Inches	Per cent	Inches	Inches	Per cent
1	1,	545	3175	483	273	2302	744	860	5014	483	767	2827	269	611	3330	445
	2,	643	5728	791	890	2569	189	800	2627	228	734	1571	114	767	3124	308
	3,	504	4141	722	967	3002	210	...	....	...	...	....	...	736	3572	385
2	4,	563	4739	742	636	2110	232	...	....	...	774	3780	388	658	3543	439
	5,	969	4721	387	498	2781	582	969	3775	290	842	3637	332	798	3729	368
	6,	321	3076	854	431	1466	240	734	4208	474	648	2746	324	534	2874	439
3	7,	...	....	...	817	2731	234	855	3623	324	711	3793	433	794	3382	326
	8,	734	3547	383	616	2715	341	1068	5543	419	1096	5578	409	879	4346	395
	9,	749	4844	546	774	2233	189	681	3324	388	478	2396	401	671	3199	377
4	10,	1065	4240	298	580	2832	388	1254	6288	401	777	4026	418	919	4347	373
	11,	731	4213	476	585	2653	354	839	4144	394	767	3825	399	731	3709	408
	12,	...	....	...	...	....	...	685	3481	408	633	3027	378	659	3254	394
5	13,	707	4925	596	648	3431	429	563	4586	715	827	4559	452	686	4375	538
	14,	...	....	...	485	3825	688	692	5137	642	548	2676	388	575	3879	574
	15,	571	3343	486	439	2665	507	669	3956	492	419	2558	510	525	3131	497
6	16.	863	4707	445	640	4960	675	1010	5778	472	930	3737	302	861	4796	457
	17,	1080	5060	369	369	2603	606	579	2499	332	306	1045	242	584	2802	380
	18,	679	4931	626	578	2315	301	...	....	...	542	2498	361	600	3248	442
7	19,	773	5507	612	505	4267	745	817	5061	520	662	3682	456	689	4629	572
	20,	740	5331	620	327	2929	796	1177	5088	333	860	4515	425	776	4466	476
	21,	619	5258	750	...	....	...	...	....	...	721	3249	351	670	4254	535
8	22,	1078	5530	413	504	3428	580	726	4010	454	777	4177	438	771	4286	459
	23,	927	5410	484	628	3182	407	657	3539	439	643	3714	477	714	3961	455
	24,	1201	4514	276	973	4235	335	713	4402	517	630	4166	562	904	4329	393
9	25,	971	4511	365	963	2964	208	1392	7108	410	841	3618	329	1042	4550	339
	26,	895	6088	580	941	4189	345	1174	5657	382	685	4592	570	924	5132	456
	27,	896	4819	498	621	1885	204	659	3350	409	1509	5311	252	899	3841	328
10	28,	910	5046	454	708	4899	592	1202	5233	335	909	4603	406	932	4945	431
	29,	1053	6883	554	270	3922	1352	733	5480	648	802	4010	400	715	5074	610
	30,	743	6746	808	548	2810	413	584	3530	504	725	4570	530	650	4414	579
	Average,	794	4853	511	612	3068	402	849	4478	428	744	3603	385	747	3980	433

* Per cent gain is computed on a basis of totals and not averages.

Gain in Twig Growth by Treatments at Vineland

The tabulation of the average twig growth in 1912, average twig growth in 1913, and per cent gain in 1913 according to treatments appears in table 15.

TABLE 15

PER CENT GAIN IN TWIG GROWTH BY TREATMENTS

VINELAND

VARIETY / TREATMENT	All 1912	All 1913	All Gain	Stump 1912	Stump 1913	Stump Gain	Carman 1912	Carman 1913	Carman Gain	Elberta 1912	Elberta 1913	Elberta Gain
	Inches	Inches	Per Cent	Inches	Inches	Per Cent	Inches	Inches	Per Cent	Inches	Inches	Per Cent
All, ...	747	3980	433	800	4258	432	750	4027	437	683	3608	428
Not Pruned, ..	709	3892	449	650	3979	512	771	3795	392	703	3913	457
Winter Not Cut Back, ..	676	3508	419	774	4259	450	690	3265	373	562	3034	440
Summer, ...	772	4262	452	873	4275	389	797	4710	491	660	3807	477
Summer and Winter, ...	790	4047	412	845	4316	411	722	3835	431	806	3971	393
Winter Cut Back, ...	784	4163	431	864	4463	416	774	4595	494	712	3486	390

It may be noted that while the "not pruned" Stump made the poorest average twig growth for the season, yet it ranked first in per cent gain, which will definitely indicate the value of a comparison upon this basis.

TWIG GROWTH MADE DURING 1913 AT NEW BRUNSWICK

With the close of the season's growth in 1913, the linear twig growth was measured, as given in table 16. As in the Vineland measurements, the amount of twig growth that was pruned off during the summer is included in the total growth. Disregarding variety, the average twig growth per tree made during the season was 3035 inches, which is 946 inches less than a similar average at Vineland. There were 29 trees above and 42 trees below this average.

The tree making the greatest amount of twig growth in this season was a Carman, Row 1, Tree 6, with a total growth of 5355 inches. The lowest Carman, Row 3, Tree 7, made a growth of 1734 inches. The average growth for all trees of this variety

was 3023 inches, of which there were 11 trees above and 16 below the average.

An Elberta, Row 5, Tree 2, made the lowest amount of twig growth, 1470 inches for all varieties. The best Elberta was Row 8, Tree 3, which made a total growth of 4425 inches. The average for this variety was 2971 inches, and 12 trees were above the average, while 15 were below.

TABLE 16

MEASUREMENT OF TWIG GROWTH

NEW BRUNSWICK, 1913

VARIETY	Tree	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	Row 9	All Plots
		NP	WNCB	W & S	S	WCB	W & S	S	WNCB	WCB	All Treatments
		Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
Elberta, ...	1	3284	2774	3042	3077	2639	2513	2971	4060	4274	
	2	2337	3062	2205	3224	1470	3141	4107	4347	2539	
	3	....	1965	2222	3276	2472	2347	2886	4425	2624	
	4	....	2939	....	....	....	....	....	....	....	
Average, ...	...	2811	2685	2490	3192	2194	2667	3321	4277	3149	2971
Stump, ...	4	4726	....	3034	2991	1684	4120	3248	2632	2709	
	5	3575	2130	2774	3302	2944	2710	3097	2931	5020	
Average, ...	...	4151	2130	2904	3147	2314	3415	3173	2782	3865	3155
Carman, ...	6	5355	1796	2495	2027	3594	3488	3717	3854	2831	
	7	4670	3013	1734	3005	3000	2407	2818	3869	4312	
	8	3100	2052	3051	2620	2248	2064	3506	2648	2350	
Average, ...	...	4375	2287	2427	2551	2947	2653	3347	3457	3164	3023
All Average, ...	...	3864	2466	2570	2940	2506	2849	3294	3596	3332	3035

Of the variety Stump, Row 9, Tree 5, made the best growth with a total of 5020 inches. Row 5, Tree 4, was lowest with 1684 inches. The average for the variety was 3155 inches, 6 trees being above and 11 below the average.

Only one tree in the above list maintains its rank within the variety held in the previous year. This is an Elberta, Row 8, Tree 3, which had the greatest amount of twig growth for the variety, both in 1912 and 1913.

The trees in the Vineland experiment made an average of 946 inches more growth per tree during 1913 than the trees in the New Brunswick experiment. The high tree in each variety

at Vineland made over 1000 inches more growth than the high trees of the same varieties at New Brunswick. Of the low trees, the low Stump at Vineland was 426 inches better than the low Stump at New Brunswick; but the low Elbertas had about the same growth in both experiments, while the low Carman at New Brunswick was about 700 inches better than the low Carman at Vineland. In all cases, however, the variety average was better by about 1000 inches at Vineland than at New Brunswick.

Comparison of Total Growth on the Basis of Treatment

TABLE 17
MEASUREMENTS OF TWIG GROWTH BY TREATMENTS
NEW BRUNSWICK, 1913

VARIETY	Not Pruned	Winter Not Cut Back	Winter Cut Back	Winter and Summer	Summer	All
Elberta, ...	2811	3510	2670	2578	3257	2971
Stump, ...	4151	2564	3089	3160	3160	3155
Carman, ...	4375	2872	3056	2540	2949	3023
All, ...	3864	3031	2919	2709	3117	3035

A comparison of the average twig growth on the basis of treatment regardless of variety (table 17) shows the following ranking:

		Inches
1.	Not pruned, ...	3864
2.	Summer only, ...	3117
3.	Winter not cut back, ...	3031
4.	Winter cut back, ...	2919
5.	Winter and summer, ...	2709

Compared with the ranking in 1912, the "not pruned" and "winter and summer" treatments occupy the same positions, but the "summer only" treatment has advanced from fourth place to second place, forcing "winter not cut back" from second to third place and "winter cut back" from third to fourth place.

When considered with respect to variety, the "not pruned" treatment ranks first with Stump and Carman, and third with Elberta; "winter not cut back" ranks first with Elberta, but fourth and fifth with Carman and Stump, respectively; winter cut back" ranks second with Carman and fourth with both

Elberta and Stump; "winter and summer" is tied with "summer" for second place with Stump, but ranks fifth with both Carman and Elberta; and "summer only" is second with Elberta and third with Carman.

A comparison of the ranking of the 1912 growth with the 1913 growth shows that with Stump no one treatment maintains its

TABLE 18. PER CENT GAIN IN TWIG GROWTH

VARIETY	Tree Number	Row 1			Row 2			Row 3			Row 4		
		NP			WNCB			W & S			S		
		1912	1913	Gain	1912	1913	Gain	1912	1913	Gain	1912	1913	Gain
		Inches	Inches	Per Cent	Inches	Inches	Per Cent	Inches	Inches	Per Cent	Inches	Inches	Per Cent
Elberta,	1	341	3284	863	246	2774	1026	433	3042	602	206	3077	1394
	2	750	2337	212	400	3062	666	250	2205	782	333	3224	868
	3	...	....	...	132	1965	1388	186	2222	1094	119	3276	2653
	4	...	....	...	427	2939	588	...	....	...	...	....	...
Average,	.....	546	2811	415	301	2685	791	290	2490	760	219	3192	1355
Stump,	4	625	4726	658	...	....	...	757	3034	301	418	2991	616
	5	490	3575	630	486	2130	352	314	2774	784	353	3302	836
Average,	.....	558	4151	644	486	2130	352	536	2904	444	386	3147	716
Carman,	6	...	....	...	108	1796	1563	427	2495	484	438	2027	363
	7	170	4670	2647	190	3013	1485	160	1734	984	532	3005	465
	8	474	3100	554	314	2052	554	334	3051	814	528	2620	396
Average,	.....	322	3885	1107	204	2287	1019	307	2427	690	499	2551	411
All Average,	.....	475	3615	661	288	2466	756	358	2570	619	366	2940	704

rank. In the case of Carman, the "winter and summer" treatment ranked fifth in both in 1912 and 1913. With Elberta, the "winter cut back" treatment ranked fourth in both years.

Comparisons on the Basis of Per Cent Gain in Twig Growth Over that of 1912

The data secured at New Brunswick seem to support the statement previously made (page 29) that a comparison between

trees on a basis of total growth indicates the size of the tree, but may not correctly indicate the rate of growth made by these trees in proportion to their vigor at the beginning.

According to the average twig growth made in 1913, Stump ranks first, Carman second, and Elberta third. When this is

AT NEW BRUNSWICK, 1913 OVER 1912

Row 5			Row 6			Row 7			Row 8			Row 9			All Rows		
WCB			W & S			S			WNCB			WCB			All Treatments		
1912	1913	Gain	1912	1913	Gain	1912	1913	Gain	1912	1913	Gain	1912	1913	Gain	1912	1913	Gain
Inches	Inches	Per Cent	Inches	Inches	Per Cent	Inches	Inches	Per Cent	Inches	Inches	Per Cent	Inches	Inches	Per Cent	Inches	Inches	Per Cent
162	2639	1528	108	2513	2227	330	2971	800	338	4060	1110	261	4274	1537			
627	1470	134	633	3141	396	267	4107	1438	493	4347	782	528	2539	381			
262	2472	844	444	2347	429	338	2886	754	797	4425	455	156	2624	1581			
...	....	...	...	....	...	...	....	...	...	....	...	...	....	...			
350	2194	526	395	2667	575	312	3321	966	543	4277	689	315	3149	899	**354**	**2971**	**739**
747	1684	125	924	4120	346	649	3248	401	653	2632	303	1239	2709	119			
606	2944	386	812	2710	234	463	3097	569	484	2931	506	324	5020	1449			
677	2314	239	868	3415	293	556	3173	470	569	2782	389	782	3865	395	**609**	**3154**	**417**
519	3594	592	318	3488	997	998	3717	272	484	3854	696	295	2831	856			
214	3000	1301	324	2407	643	508	2818	455	624	3869	520	306	4312	1309			
334	2248	573	270	2064	664	310	3506	1030	540	2648	404	680	2350	246			
356	2947	726	304	2653	773	605	3347	453	549	3457	530	427	3164	641	**400**	**2933**	**634**
434	2506	478	479	2849	495	483	3294	582	552	3596	554	474	3332	604	433	3002	**594**

considered on the basis of gain in growth, Elberta ranks first with a gain of 739 per cent, Carman second with 634 per cent, and Stump third with 417 per cent. Table 18 shows the per cent gain made by each tree and the average per cent gain for each variety, all varieties, and for each row for each variety and all varieties.

Gain in Twig Growth According to Treatments

The per cent gain in twig growth according to treatments is given in table 19.

TABLE 19

PER CENT GAIN IN TWIG GROWTH ACCORDING TO TREATMENTS
NEW BRUNSWICK, 1913

VARIETY	Not Pruned	Winter Not Cut Back	Winter Cut Back	Winter and Summer	Summer	All
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Elberta, ...	415	732	702	653	692	739
Stump, ...	644	374	324	350	572	417
Carman, ...	1107	662	681	732	434	634
All, ...	661	622	544	591	634	594

The ranking on this basis is as follows:

	ALL	ELBERTA	STUMP	CARMAN
1	Not pruned	Winter not cut back	Not pruned	Not pruned
2	Summer	Winter cut back	Summer	Winter and summer
3	Winter not cut back	Summer	Winter not cut back	Winter cut back
4	Winter and summer	Winter and summer	Winter and summer	Winter not cut back
5	Winter cut back	Not pruned	Winter cut back	Summer

A COMPARISON OF THE GROWTH MADE BY TREES OF VARYING VIGOR

In making extensive observations of tree growth at this station, it has appeared that trees that make a relatively small growth during the first season make a relatively large gain in growth during the following season, if growing conditions are equally favorable to all trees. The measurements of growth made in these experiments have furnished additional data upon this point.

At the close of the first summer's growth after the trees are planted, there is commonly a considerable variation in size, or really in the amount of twig growth made, even though the trees were all of about the same caliper and vigor at the time of

planting. These differences occur as a result of several factors. Some individual trees may have lost a larger proportion of their root-systems when dug from the nursery row; some may have become partially dried out previous to planting; and still others may not have been set quite so well. The soil, too, is far from being uniform in fertility, water-holding capacity, and depth of surface soil, over any considerable area, so that some individual trees find exceptionally good conditions, while others are subjected to more or less unfavorable factors. There is the possibility, too, that some individuals may inherit greater vigor than others.

TABLE 20

PER CENT IN TWIG GROWTH MADE BY TREES ABOVE AND BELOW THE AVERAGE FOR THE VARIETY IN 1912—VINELAND, 1913

VARIETY	BELOW AVERAGE				ABOVE AVERAGE			
	No. of Trees	Growth 1912	Growth 1913	Gain	No. of Trees	Growth 1912	Growth 1913	Gain
		Inches	Inches	Per cent		Inches	Inches	Per cent
Stump, ...	20	642	3873	504	18	976	4675	379
Carman, ...	21	577	3509	508	18	953	4629	386
Elberta, ...	18	549	3066	458	15	844	4258	404
All, ...	62	591	3563	503	48	949	4516	376

It is certain, however, that environmental factors tend to cause marked differences in growth, especially the first season after the trees have been transplanted. Since these differences occur generally, it is of interest to determine, as far as possible, the degree and relative importance of these differences in the development of the orchard. A somewhat general comparison may be made between trees above and below the general average of the entire orchard. Table 20 shows the average growth in 1912 and in 1913, and the per cent gain in twig growth for trees that were above and below the average amount of twig growth at Vineland in 1912. It will be noted that although the trees above the average in 1912 made the larger amount of twig growth in 1913 by an average or nearly 1000 inches, the per cent gain in twig growth was more than 100 per cent in favor of those below the average.

The results at New Brunswick are even more striking, as shown in table 21. The trees that were below the average in 1912 made almost as much average growth in 1913 as the trees that were above the average, the difference being only about 100 inches. The average per cent gain in twig growth of the trees below the average was more than 200 per cent greater than that of the trees above the average.

TABLE 21

PER CENT GAIN IN GROWTH MADE BY TREES ABOVE AND BELOW THE AVERAGE GROWTH IN 1912—NEW BRUNSWICK, 1913

VARIETY	BELOW AVERAGE				ABOVE AVERAGE			
	No. of Trees	Growth 1912	Growth 1913	Gain	No. of Trees	Growth 1912	Growth 1913	Gain
		Inches	Inches	Per cent		Inches	Inches	Per cent
Elberta, ...	17	237	2975	1154	10	553	2965	433
Stump, ...	9	438	3196	630	8	801	3108	288
Carman, ...	14	261	2869	1000	12	563	3008	435
All, ...	38	273	2931	1052	32	583	3028	420

In order to study the matter in further detail and to determine, if possible, what amount of difference in twig growth is an economic factor, the trees are grouped in table 22 according to differences of 100 inches in linear twig growth in 1912. In this table the following trees are omitted because they are obviously abnormal as to growth: in the Vineland orchard, Row 17, Tree 5, which had a growth in 1912 and 1913 of 306 inches and 1045 inches, respectively; Row 6, Tree 3, 431 inches and 1466 inches, respectively; and Row 2, Tree 5, 734 inches and 1571 inches, respectively. Two trees in the New Brunswick orchard also have been omitted from the calculations; Row 5, Tree 4, with a growth of 747 inches in 1912 and 1684 inches in 1913, and Row 5, Tree 2, with a growth of 627 and 1470 inches in 1912 and 1913, respectively.

In an examination of the Vineland results it may be noted that the per cent gain in growth during the second season was practically in inverse proportion to the amount of growth made in 1912. In other words, the trees that made the smallest growth during the first season made the greatest per cent increase in twig growth during the second season. In actual total of growth,

however, the larger the trees in 1912 the greater was the growth in 1913. For example, trees averaging 553 inches of growth in 1912 made an average growth of 3299 inches, or a gain of 496 per cent. On the other hand, trees that averaged 947 inches in 1912 made an average growth of 4199 inches in 1913, which is a gain of only 343 per cent.

TABLE 22

COMPARISON OF GAIN IN LINEAR TWIG GROWTH BETWEEN TREES OF VARYING VIGOR (TREES GROUPED ON BASIS OF 100 INCHES DIFFERENCE IN TOTAL TWIG GROWTH IN 1912).

SIZE OF TREES 1912	Vineland				New Brunswick			
	Number Trees	Average Growth 1912	Average Growth 1913	Gain	Number Trees	Average Growth 1912	Average Growth 1913	Gain
Inches		Inches	Inches	Per Cent		Inches	Inches	Per Cent
100–200, ...	..	...	....	....	10	149	2646	1673
201–300, ...	2	272	3112	1046	9	252	2978	1079
301–400, ...	3	339	2869	746	16	332	3228	872
401–500, ...	5	446	2845	538	13	459	2998	554
501–600, ...	15	553	3299	496	6	526	2871	446
601–700, ...	21	651	3758	477	7	639	3273	413
701–800, ...	22	745	4237	469	3	768	3265	325
801–900, ...	14	844	4221	400	1	812	2710	233
901–1000, ...	11	947	4199	343	2	961	3919	308
1001–1100, ...	7	1064	5516	418	..	...	....	....
1101–1200, ...	2	1176	5373	357	..	...	....	....
Over 1200, ...	5	1312	5691	334	..	...	....	....

The same general facts are noted in the results at New Brunswick. The per cent gain in 1913 is in inverse ratio to the amount of growth in 1912. There are some exceptions to the general rule demonstrated at Vineland, that the total growth in 1913 was in proportion to the total growth in 1912, but the general tendency was in that direction. The fact that the number of trees at New Brunswick was rather limited may account for the somewhat variable results.

It is now of interest to compare in more detail the behavior of different groups of trees arranged on a basis of 100 inches difference in total twig growth in 1912. The greatest number of trees at Vineland in any group was 22, and occurred in those ranging from a total of 701 to 800 inches, while the group of trees 100 inches smaller in size was represented by 21 trees. There was not a single individual at Vineland with less than 200 inches of twig growth, and there were five trees exceeding 1200 inches.

Although the trees planted at New Brunswick were from the same source, and were planted on a fertile red shale soil, they did not make nearly as free a growth as those at Vineland. The greatest number of trees at New Brunswick in any one group was 16, in those ranging from a total of 301 to 400 inches, and there were 10 trees within the group 101–200 inches. There was not a single tree exceeding a total of 1000 inches of growth.

In the Vineland experiment 100 inches difference in twig growth in trees ranging from an average of 745 to 947 inches did not make itself evident during 1913, as may be noted by an examination of table 22. Each additional 100 inches of growth on trees ranging from 446 inches to those averaging 745 inches did apparently have an influence upon the growth of 1913. In these three groups a difference of about 100 inches in 1912 increased to 454, 459 and 479, respectively, in 1913. A very marked gain is shown by the group averaging 1064 inches in 1912 over that averaging 947 inches, a difference of 117 inches of twig growth in 1912 increasing to 1317 inches in 1913.

At New Brunswick there is very little difference between the various groups of trees ranging from 332 to an average of 768 inches. A difference of 200 inches in twig growth the first season may not, therefore, indicate any marked difference the second season.

One would expect that 100 inches difference in growth would be a more pronounced factor with trees of certain sizes than with others. In general, one might be led to infer that such a difference would continue to be more apparent between small trees than it would between medium to large trees. But such is not the case in these experiments. Not only have the very small trees made a very remarkable gain in growth, but the trees having the smallest average in 1912 are better than the group which averaged 100 inches larger in both orchards in 1912.

Certain groups of trees of a medium to large size are apparently not very sensitive to a difference of 100 inches in growth the first season. Just why there are marked differences of increase in twig growth between some groups and not between others the writers are unable to say.

In order to make still further comparisons, the trees were arranged in groups on the basis of a difference of 50 inches of

total twig growth and the results appear in table 23. As in the previous table a few obviously abnormal trees were omitted from the calculations. The number of trees in several of the groups is too limited to make the results dependable, yet certain points may be gathered.

TABLE 23

COMPARISON OF GAINS IN LINEAR TWIG GROWTH BETWEEN TREES OF VARYING VIGOR (TREES GROUPED ON BASIS OF 50 INCHES DIFFERENCE IN TOTAL TWIG GROWTH IN 1912).

SIZE OF TREES 1912	Vineland				New Brunswick			
	Number Trees	Average Growth 1912	Average Growth 1913	Gain	Number Trees	Average Growth 1912	Average Growth 1913	Gain
Inches		Inches	Inches	Per Cent		Inches	Inches	Per Cent
100–150, ...	..	...	....	....	4	117	2388	1941
151–200, ...	..	...	....	....	6	171	2817	1547
201–250, ...	..	...	....	....	4	229	2764	1107
251–300, ...	2	272	3112	1046	5	271	3150	1062
301–350, ...	2	324	3002	827	14	325	3235	895
351–400, ...	1	369	2603	606	2	377	3182	744
401–450, ...	3	422	2668	532	6	431	2640	512
451–500, ...	2	482	3111	546	7	482	3291	583
501–550, ...	7	528	3285	522	6	526	2871	446
551–600, ...	8	575	3312	476	..	...	....	....
601–650, ...	12	634	3577	465	5	627	3586	472
651–700, ...	9	674	3999	493	2	667	2491	273
701–750, ...	14	727	4587	531	1	750	2337	212
751–800, ...	8	776	3625	367	2	777	3729	380
801–850, ...	8	824	4072	394	1	812	2710	233
851–900, ...	6	871	4419	408	..	...	....	....
901–950, ...	5	923	4597	398	1	924	4120	346
951–1000, ...	6	969	3868	299	1	998	3717	272
1001–1050, ...	1	1010	5778	472	..	...	....	....
1051–1100, ...	6	1074	5472	410	..	...	....	....
1101–1150, ...	..	...	....	....	..	...	....	....
1151–1200, ...	2	1176	5373	357	..	...	....	....
1201–1250, ...	2	1202	4874	306	1	1239	2709	118

The trees falling into the first or lowest groups in terms of total twig growth in 1912 made such gains as to be larger than the trees in what was the third group in size in 1912. This holds true for both orchards.

Beginning with the group of trees averaging 575 inches of twig growth at Vineland in 1912, the 50-inch groups, up to and including the group 701–750 inches, showed in the total for 1913 gains of 265 inches, 422 inches and 588 inches, respectively. Beyond this point there is a decrease for 3 groups.

In the New Brunswick experiments a difference of 50 inches in twig growth between the first two groups of trees in 1912

had increased to an average difference of 429 inches in 1913. Other marked differences may be noted between certain groups, but there is no regular ascending scale of increase exhibited by the groups of trees. The numbers of trees are limited in these studies and some irregularity of results is to be expected. However, there is some factor which brings about a considerable gain in twig growth during the second season in trees that average 50 inches larger in total twig growth than the next lower group, while between other groups a difference of 50 inches in average total twig growth during the first season is apparently a negligible factor in the results of the second season.

INDIVIDUAL DIFFERENCES

The wide difference between the individuals within a group is of interest at this point. The 551–600 group at Vineland in 1912 showed a range in total growth of 2499 to 4739 inches in 1913; the 601–650 group in 1912 showed individual differences in development ranging from 2110 to 5258 inches in 1913. At New Brunswick the 151–200 group in 1912 had individuals ranging from 1734 to 4670 inches in 1913. The variation in the amount and per cent gain in twig growth between individual peach trees during the second season is very great. It is too early in the progress of the experiments, however, to determine the significance of these differences in terms of the economic welfare of the orchard.

MEASUREMENT OF CIRCUMFERENCE OF TRUNKS OF TREES AT VINELAND, 1913

The circumference of the trunks 6 inches above the surface of the soil was taken at the close of the season of 1913, and the results are given in table 24.

The average circumference of all the trees in the experiments at the close of 1913 was 8.04 inches. The largest tree was Row 26, Tree 3 (Carman), with a circumference of 10.25 inches. The smallest tree was Row 2, Tree 3 (Carman), with a circumference of 5.50 inches. There were 42 trees above and 55 below the average on the basis of all trees regardless of variety.

The average circumference of the Stump trees was 8.14 inches, of which 15 were above and 20 below this average (table 25). Two trees, Row 1, Tree 4, and Row 10, Tree 4, made the greatest total growth in circumference, 9.75 inches. The tree having the smallest circumference was Row 22, Tree 3, with a total of 7.00 inches.

TABLE 24
MEASUREMENT OF CIRCUMFERENCES
VINELAND, 1913

PRUNING REATMENT	Row	Variety	*Tree 1	Tree 2	Tree 3	Tree 4	Tree 5	Average
			Inches	Inches	Inches	Inches	Inches	Inches
Not	1	Stump, ...	....	7.75	....	9.75	7.25	8.25
pruned	2	Carman, ...	....	8.75	5.50	7.75	7.50	7.38
	3	Elberta, ...	....	....	....	....	....	....
Winter	4	Stump, ...	....	8.25	8.00	....	8.25	8.17
not cut	5	Carman, ...	8.00	8.25	9.00	8.75	8.25	8.56
back	6	Elberta, ...	....	6.50	7.00	8.00	8.25	7.44
Summer	7	Stump, ...	....	....	7.25	7.75	8.00	7.67
only	8	Carman.	....	7.50	7.50	....	9.25	8.08
	9	Elberta, ...	5.75	7.75	7.00	7.50	7.75	7.50
Winter	10	Stump, ...	7.00	7.25	7.50	9.75	9.00	8.38
and	11	Carman, ...	7.75	7.75	7.25	8.00	8.50	7.87
summer	12	Elberta, ...	5.25	....	....	7.00	8.00	7.50
Winter	13	Stump, ...	6.50	7.50	7.50	7.50	8.75	7.81
cut	14	Carman, ...	....	....	8.25	9.50	7.50	8.41
back	15	Elberta, ...	....	6.75	8.75	8.25	7.00	7.68
Winter	16	Stump, ...	6.50	....	8.50	9.25	7.50	8.41
not cut	17	Carman, ...	....	9.00	7.00	7.75	5.75	7.37
back	18	Elberta, ...	6.00	....	7.50	....	8.75	8.12
Not	19	Stump, ...	6.75	....	7.50	8.00	9.50	8.33
pruned	20	Carman, ...	6.25	....	....	9.50	9.75	9.62
	21	Elberta, ...	8.00	....	7.75	....	....	7.75
Winter	22	Stump, ...	7.25	8.50	7.00	7.75	7.50	7.68
and	23	Carman, ...	....	8.25	7.25	7.50	7.75	7.68
summer	24	Elberta, ...	6.25	7.75	....	7.00	6.75	7.16
Winter	25	Stump, ...	7.25	8.50	8.25	9.50	9.00	8.81
cut	26	Carman, ...	6.75	9.50	10.25	9.50	8.50	9.43
back	27	Elberta, ...	....	7.75	8.00	8.50	9.25	8.37
Summer	28	Stump, ...	6.25	8.00	7.50	8.25	8.00	7.93
only	29	Carman, ...	6.25	8.25	7.50	8.50	9.00	8.31
	30	Elberta, ...	6.00	....	....	7.00	8.50	7.75

* Tree 1 in each row is not included in the averages for the rows.

Carman showed the greatest average growth in circumference with a total of 8.20 inches, of which variety 20 trees were above and 16 below the average. It was also represented by the largest and the smallest trees in circumference in the experiments as previously noted.

The Elberta trees made an average circumference of 7.69 inches, of which 15 trees were above and 11 below the average. Row 27, Tree 5, was the largest of these with a circumference of 9.25 inches, and Row 6, Tree 2, was the smallest, with a circumference of 6.50 inches.

Average of Circumference Arranged According to Future Treatments

The measurement of the circumferences at Vineland at the close of the season of 1913, averaged by future treatments, is shown in table 25.

TABLE 25

AVERAGE OF CIRCUMFERENCES ACCORDING TO TREATMENTS
VINELAND, 1913

VARIETY	Not Pruned			Winter Not Cut Back			Summer			Winter and Summer			Winter Cut Back			All Treatments	
	Plot	No. trees	Average per tree	Plot	No. trees	Average per tree	Plot	No. trees	Average per tree	Plot	No. trees	Average per tree	Plot	No. trees	Average per tree	No. trees	Average per tree
			In.			In.			In.			In.			In.		In.
All, ...	1	7	7.75	2	11	8.05	3	10	7.73	4	10	8.00	5	11	7.93		
	7	6	8.67	6	9	7.89	10	10	8.05	8	11	7.55	9	12	8.88		
		13	8.17		20	7.98		20	7.89		21	7.76		23	8.42	97	8.04
Stump, ...	1	3	8.25	2	3	8.17	3	3	7.67	4	4	8.38	5	4	7.81		
	7	3	8.33	6	3	8.41	10	4	7.93	8	4	7.68	9	4	8.81		
		6	8.29		6	8.29		7	7.82		8	8.03		8	8.31	35	8.14
Carman, ...	1	4	7.38	2	4	8.56	3	3	8.08	4	4	7.87	5	3	8.41		
	7	2	9.62	6	4	7.37	10	4	8.31	8	4	7.68	9	4	9.43		
		6	8.13		8	7.97		7	8.21		8	7.78		7	9.00	36	8.20
Elberta, ...	1	..	....	2	4	7.44	3	4	7.50	4	2	7.50	5	4	7.68		
	7	1	7.75	6	2	8.12	10	2	7.75	8	3	7.16	9	4	8.37		
		1	7.75		6	7.67		6	7.58		5	7.30		8	8.03	26	7.69

A comparison of the ranking in 1912 with the ranking in 1913 is given in table 26.

Little consistency is shown at present by this tabulation. Stump "summer" has the same rank in both years and Stump "winter not cut back" ranked second in 1912 and tied with "not pruned" for second in 1913. Other than these, the rankings have changed.

Fig. 1. Winter 1912–1913
Twig Growth, 773 Inches

Fig. 2. Winter 1913–1914
Twig Growth, 5507 Inches

Stump Tree, Not Pruned, Vineland, Row 19, Tree 2

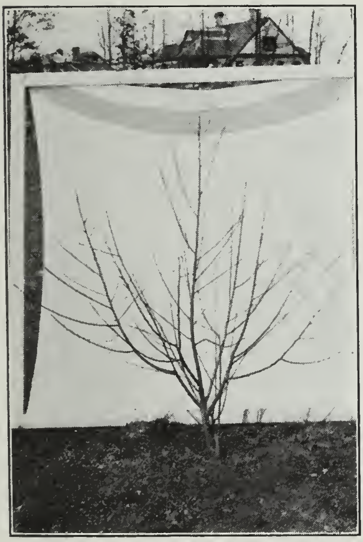

Fig. 3. Winter 1912–1913
Twig Growth, 1177 Inches

Fig. 4. Winter 1913–1914
Twig Growth, 5088 Inches

Carman Tree, Not Pruned, Vineland, Row 20, Tree 4

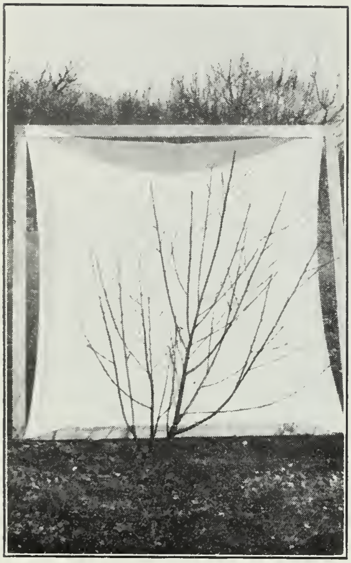

Fig. 5. Before Pruning, 1912–1913
Twig Growth, 1080 Inches

Fig. 7. Before Pruning, 1913–1914
Twig Growth, 5060 Inches

Fig. 6. After Pruning, 1912–1913

Fig. 8. After Pruning, 1913–1914
Twig Growth Pruned Off, 2365 Inches

Carman Tree, "Winter Not Cut Back," Vineland, Row 17, Tree 2

Fig. 9. Before Pruning, 1912–1913
Twig Growth, 542 Inches

Fig. 11. Before Pruning, 1913–1914
Twig Growth, 2498 Inches

Fig. 10. After Pruning, 1912-1913

Fig. 12. After Pruning, 1913–1914
Twig Growth Pruned Off, 1047 Inches

Elberta Tree, "Winter Not Cut Back," Vineland, Row 18, Tree 5

Fig. 13. Before Pruning, 1912–1913
Twig Growth, 640 Inches.

Fig. 15. Before Pruning, 1913–1914
Twig Growth, 4960 Inches

Fig. 14. After Pruning, 1912–1913

Fig. 16. After Pruning, 1913–1914
Twig Growth Pruned Off, 1441 Inches

Stump Tree, "Winter Not Cut Back," Vineland, Row 16, Tree 3

Fig. 17. Before Pruning, 1912–1913
Twig Growth, 963 Inches

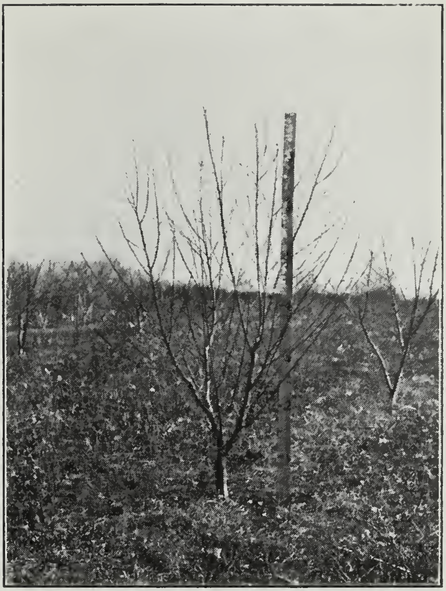

Fig. 19. Before Pruning, 1913–1914
Twig Growth, 2964 Inches

Fig. 18. After Pruning, 1912–1913

Fig. 20. After Pruning, 1913–1914
Twig Growth Pruned Off, 1952 Inches

Stump Tree, "Winter Cut Back," Vineland, Row 25, Tree 3

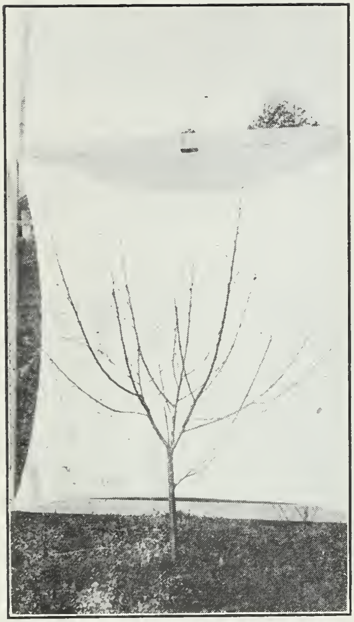

Fig. 21. Before Pruning, 1912–1913
Twig Growth, 548 Inches

Fig. 23. Before Pruning, 1913–1914
Twig Growth, 2676 Inches

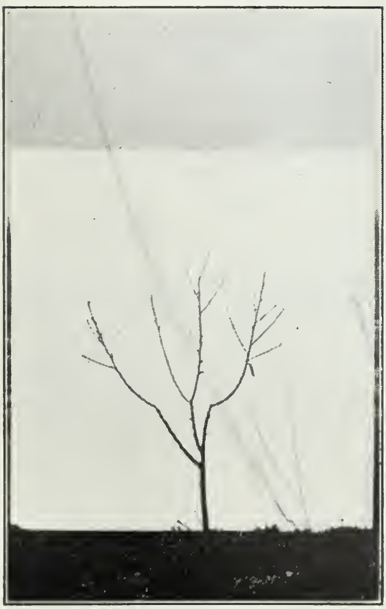

Fig. 22. After Pruning, 1912–1913

Fig. 24. After Pruning, 1913–1914
Twig Growth Pruned Off, 909 Inches

Carman Tree, "Winter Cut Back," Vineland, Row 14, Tree 5

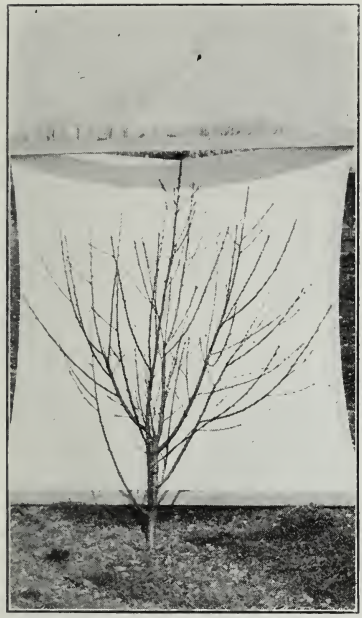

Fig. 25. Before Pruning, 1912–1913
Twig Growth, 1254 Inches

Fig. 27. Before Pruning, Summer, 1913

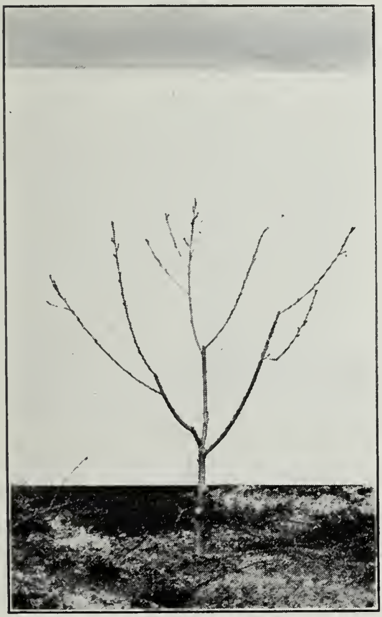

Fig. 26. After Pruning, 1912–1913

Fig. 28. After Pruning, Summer, 1913
Twig Growth Pruned Off, 1347 Inches

Stump Tree, "Winter and Summer," Vineland, Row 10, Tree 4

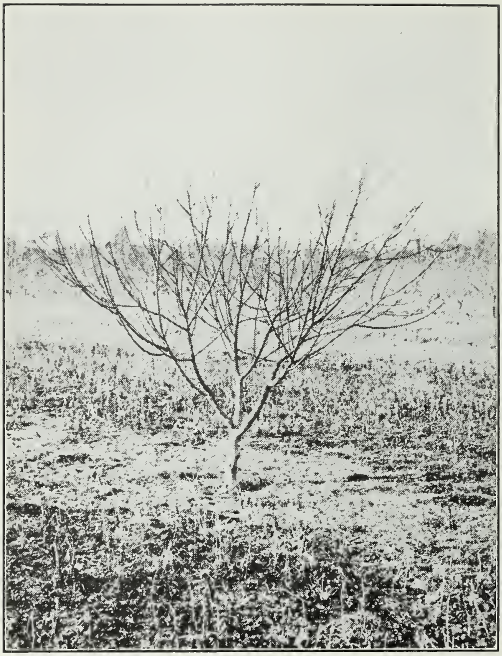

Fig. 29. Before Pruning, 1913–1914
Twig Growth, Including Summer Pruning, 6288 Inches

Fig. 30. After Pruning, 1913–1914
Twig Growth Pruned Off, 3180 Inches

Stump Tree, "Winter and Summer," Vineland, Row 10, Tree 4

Fig. 31. Before Pruning, 1912–1913
Twig Growth, 685 Inches

Fig. 33. Before Pruning, Summer, 1913

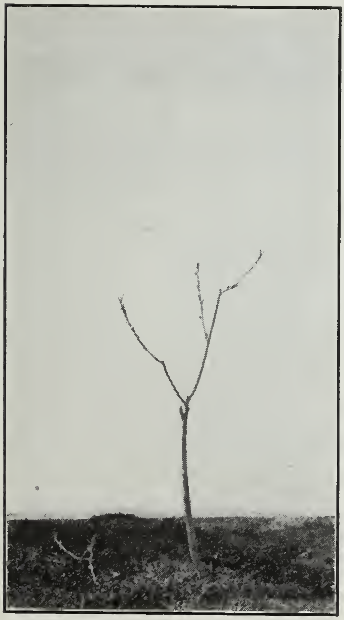

Fig. 32. After Pruning, 1912–1913

Fig. 34 After Pruning, Summer, 1913
Twig Growth Pruned Off, 860 Inches

Elberta Tree, "Winter and Summer," Vineland, Row 12, Tree 4

Fig. 35. Before Pruning, 1913–1914
Twig Growth, Including Summer Pruning, 3481 Inches

Fig. 36. After Pruning, 1913–1914
Twig Growth Pruned Off, 1454 Inches

Elberta Tree, "Winter and Summer," Vineland, Row 12, Tree 4

Fig. 37. Before Pruning, 1912–1913
Twig Growth, 973 Inches

Fig. 39. Before Pruning, July, 1913

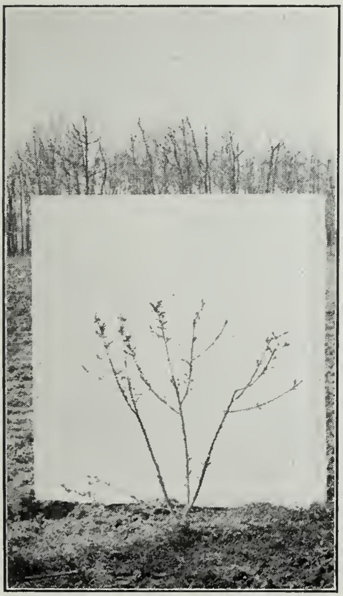

Fig. 38. After Pruning, 1912–1913

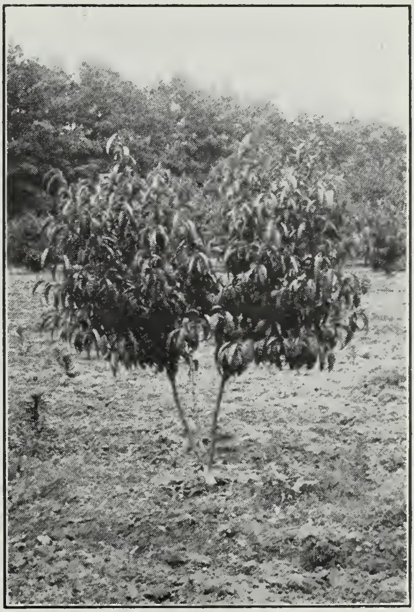

Fig. 40. After Pruning, July, 1913
Twig Growth Pruned Off, 936 Inches

Elberta Tree, "Winter and Summer," Vineland, Row 24, Tree 3

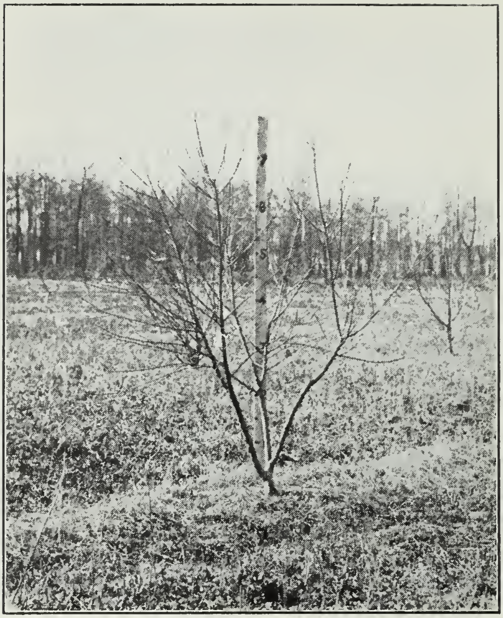

Fig. 41. Before Pruning, 1913–1914
Twig Growth, Including Summer Pruning, 4235 Inches

Fig. 42. After Pruning, 1913–1914
Twig Growth Pruned Off, 1556 Inches

Elberta Tree, "Winter and Summer," Vineland, Row 24, Tree 3

Fig. 43. Before Pruning, 1912–1913
Twig Growth, 1068 Inches

Fig. 45. Before Pruning, July, 1913

Fig. 44. After Pruning, 1912–1913

Fig. 46. After Pruning, July, 1913
Twig Growth Pruned Off, 1252 Inches

Carman Tree, "Summer Only," Vineland, Row 8, Tree 4

Fig. 47. Before Pruning, October, 1913

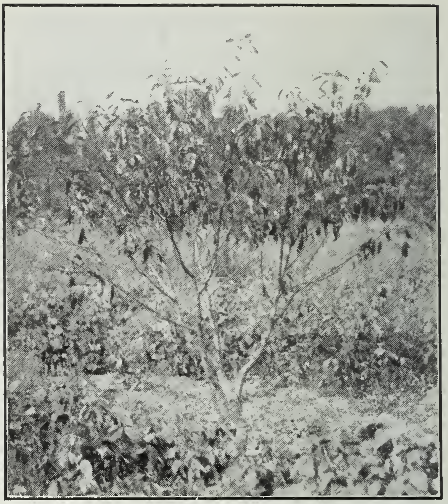

Fig. 48. After Pruning, October, 1913
Twig Growth Pruned Off, 1062 Inches

Fig. 49. Aspect in Winter, 1913–1914
Twig Growth, Total, Including Summer Pruning, 5543
Twig Growth Remaining, 3229 Inches

Carman Tree, "Summer Only," Vineland, Row 8, Tree 4

Fig. 50. Before Pruning, 1912–1913
Twig Growth, 119 Inches

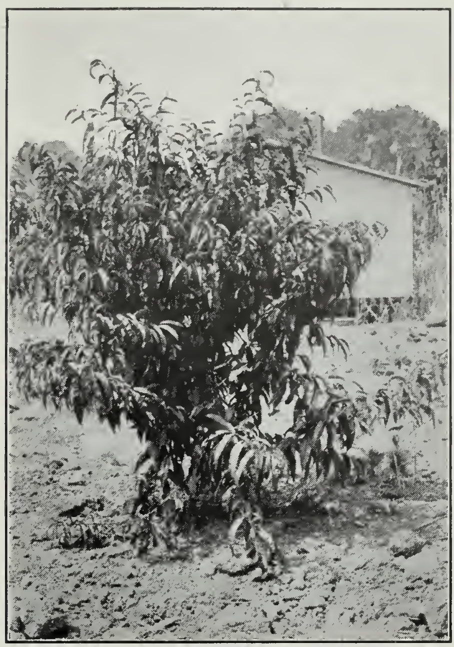

Fig. 52. Before Pruning, July, 1913

Fig. 51, After Pruning, 1912–1913

Fig. 53. After Pruning, July, 1913
Twig Growth Pruned Off, 1311 Inches

Elberta Tree, "Summer Only," New Brunswick, Row 4, Tree 3

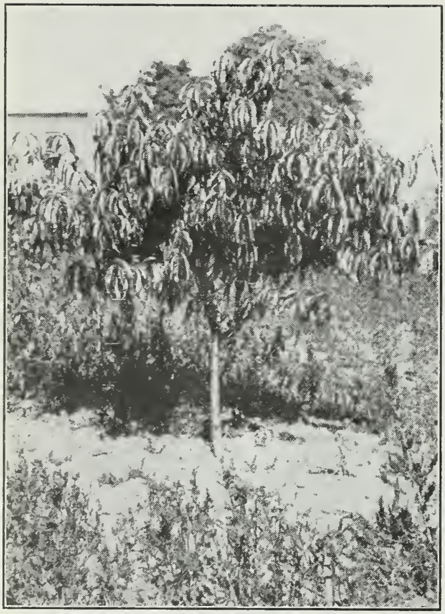

Fig. 54. Before Pruning, Oct., 1913

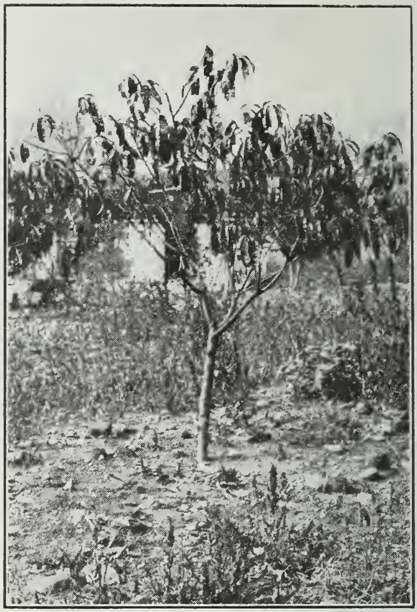

Fig. 55. After Pruning, Oct., 1913
Twig Growth Pruned Off, 328 Inches

Fig. 56. Aspect in Winter, 1913–1914
Twig Growth, Total, Including Summer Pruning, 3276 Inches
Twig Growth Remaining, 1637 Inches

Elberta Tree, "Summer Only," New Brunswick, Row 4, Tree 3

TABLE 26

COMPARISON OF THE RANKING AS TO AVERAGE OF TRUNK CIRCUMFERENCE OF THE VARIOUS TREATMENTS IN 1912 AND 1913 AT VINELAND

TREATMENT	All		Stump		Carman		Elberta	
	1912	1913	1912	1913	1912	1913	1912	1913
Not pruned,	1	2	3	2	1	3	*5	2
Winter not cut back,	4	3	2	2	5	4	1	3
Winter cut back,	3	1	4	1	2	1	3	1
Winter and summer,	2	5	1	4	3	5	3	5
Summer,	5	4	5	5	4	2	2	4

* One tree.

Per Cent Increase in Trunk Circumference During 1913

Since the trees were compared on the basis of per cent gain in twig growth, it is of interest to compare them as to per cent increase in trunk circumference also. Table 27 shows the circumference in 1912 and 1913 and the per cent increase for each tree.

The varieties rank as follows on the basis of per cent gain in circumference during 1913 regardless of treatment: (1) Carman, with 109 per cent; (2) Elberta, with 108 per cent; and, (3) Stump, with 96 per cent. Thus the rank according to gain in circumference differs from that according to per cent gain in twig growth, since Elberta ranks second in the former case and third in the latter.

Actual and Per Cent Gain in Circumference Compared on Basis of Treatment

Table 28 shows the average circumferences for 1912 and 1913 and the per cent gain in circumference, arranged according to treatment. Tables 29 and 30 show in detail the ranking of the various treatments according to twig growth, circumference and per cent gain in each case.

It will be noted that the treatments rank the same when compared on the basis of average twig growth and average circumference, regardless of variety. Differences may be noted in rank, however, on the basis of the individual variety.

TABLE 27

PER CENT INCREASE IN TRUNK CIRCUMFERENCE AT VINELAND, 1913 OVER 1912

Plot	Row	Tree 2 1912	Tree 2 1913	Tree 2 Gain	Tree 3 1912	Tree 3 1913	Tree 3 Gain	Tree 4 1912	Tree 4 1913	Tree 4 Gain	Tree 5 1912	Tree 5 1913	Tree 5 Gain	Average 1912	Average 1913	Average Gain
		Inches	Inches	Per cent	Inches	Inches	Per cent	Inches	Inches	Per cent	Inches	Inches	Per cent	Inches	Inches	Per cent
1	1.	3.37	7.75	130	....	....	...	5.00	9.75	95	4.25	7.25	71	4.21	8.25	96
	2.	4.25	8.75	106	4.12	5.50	34	3.50	7.75	121	4.75	7.50	58	4.16	7.38	77
	3.	....	....	...	....	....	...	....	....	...	....	....	...	....	....	...
2	4.	3.50	8.25	136	4.00	8.00	100	....	....	...	4.37	8.25	89	3.96	8.17	106
	5.	3.36	8.25	145	3.25	9.00	177	3.37	8.75	160	4.37	8.25	89	3.59	8.56	139
	6.	3.62	6.50	80	3.66	7.00	91	3.75	8.00	113	4.00	8.25	106	3.76	7.44	98
3	7.	....	....	...	4.25	7.25	71	3.88	7.75	100	4.88	8.00	64	4.34	7.67	77
	8.	2.12	7.50	254	4.25	7.50	77	....	....	...	5.25	9.25	76	3.87	8.08	109
	9.	3.75	7.75	107	3.25	7.00	115	4.25	7.50	77	3.75	7.75	107	3.75	7.50	100
4	10.	3.75	7.25	93	4.00	7.50	88	5.12	9.75	90	4.50	9.00	100	4.34	8.38	93
	11,	3.75	7.75	107	3.88	7.25	87	3.75	8.00	113	4.62	8.50	84	4.00	7.87	97
	12,	....	....	...	....	....	...	3.12	7.00	124	3.62	8.00	121	3.37	7.50	123
5	13.	3.62	7.50	106	4.00	7.50	88	3.75	7.50	100	4.62	8.75	89	4.00	7.81	95
	14,	....	....	...	3.88	8.25	113	3.12	9.50	204	3.62	7.50	107	3.54	8.41	138
	15,	2.50	6.75	170	3.88	8.75	126	3.37	8.25	145	3.50	7.00	100	3.31	7.68	132
6	16,	....	....	...	3.75	8.50	127	4.75	9.25	95	4.75	7.50	58	4.42	8.41	91
	17,	4.12	9.00	119	3.36	7.00	108	4.00	7.75	94	3.37	5.75	71	3.95	7.37	99
	18,	....	....	...	2.88	7.50	160	....	....	...	5.12	8.75	71	4.00	8.12	103
7	19,	....	....	...	3.88	7.50	93	4.00	8.00	100	4.50	9.50	111	4.13	8.33	102
	20,	....	....	...	....	....	...	4.37	9.50	117	5.00	9.75	95	4.69	9.62	105
	21,	....	....	...	3.00	7.75	158	....	....	...	....	....	...	3.00	7.75	158
8	22,	4.88	8.50	74	3.88	7.00	80	4.25	7.75	82	4.25	7.50	77	4.32	7.68	78
	23,	4.00	8.25	106	3.50	7.25	107	3.62	7.50	107	4.00	7.75	94	3.78	7.68	103
	24,	3.75	7.75	107	....	....	...	3.50	7.00	100	4.37	6.75	55	3.87	7.16	85
9	25,	4.25	8.50	100	3.88	8.25	113	4.37	9.50	117	4.37	9.00	106	4.22	8.81	109
	26,	4.88	9.50	95	3.50	10.25	192	4.75	9.50	100	4.12	8.50	106	4.31	9.43	119
	27,	3.75	7.75	107	3.25	8.00	146	4.12	8.50	106	5.00	9.25	85	4.03	8.37	108
10	28,	3.12	8.00	156	3.75	7.50	100	3.88	8.25	113	4.12	8.00	94	3.72	7.93	114
	29,	4.12	8.25	100	2.75	7.50	173	4.25	8.50	100	4.37	9.00	106	3.87	8.31	115
	30,	....	....	...	....	....	...	3.36	7.00	108	3.75	8.50	126	3.56	7.75	118
Average.		3.72	7.98	114	3.66	7.69	110	3.96	8.30	109	4.33	8.17	89	3.91	7.88	102

TABLE 28

PER CENT INCREASE IN CIRCUMFERENCE ACCORDING TO TREATMENTS VINELAND, 1913 OVER 1912

TREATMENT	All			Stump			Carman			Elbert		
	1912	1913	Gain	1912	1913	Gain	1912	1913	Gain	1912	1913	Gain
	Inches	Inches	Per Cent	Inches	Inches	Per Cent	Inches	Inches	Per Cent	Inches	Inches	Per Cent
All, ...	3.94	8.04	104	4.16	8.14	96	3.92	8.20	109	3.69	7.69	108
Not pruned, ..	4.15	8.17	97	4.17	8.29	99	4.33	8.13	88	3.00	7.75	158
Winter not cut back, ...	3.87	7.98	106	4.19	8.29	97	3.65	7.97	119	3.84	7.67	100
Summer, ...	3.85	7.89	105	3.98	7.82	97	3.87	8.21	112	3.69	7.58	105
Summer and winter, ...	4.01	7.76	93	4.33	8.03	86	3.89	7.78	100	3.67	7.30	99
Winter cut back, ...	3.93	8.42	114	4.11	8.31	102	3.98	9.00	126	3.67	8.03	119

TABLE 29

RELATIVE RANK OF TREATMENTS, 1912 AND 1913, AND PER CENT GAIN ACCORDING TO CIRCUMFERENCE OF TRUNKS

	All			Stump			Carman			Elberta		
	1912	1913	Per Cent Gain	1912	1913	Per Cent Gain	1912	1913	Per Cent Gain	1912	1913	Per Cent Gain
Not pruned, ..	4	4	97	3	2	99	1	3	88	5	2	158*
Winter not cut back, ...	5	5	106	2	3	97	5	4	119	4	3	100
Summer only, .	3	1	105	5	4	97	4	2	112	1	4	105
Winter and summer, ...	1	3	93	1	5	86	3	5	100	3	5	99
Winter cut back, ...	2	2	114	4	1	102	2	1	126	2	1	119

* 1 tree only.

TABLE 30

RELATIVE RANK OF TREATMENTS, 1912 AND 1913, AND PER CENT GAIN ACCORDING TO TWIG GROWTH

	All			Stump			Carman			Elberta		
	1912	1913	Per Cent Gain	1912	1913	Per Cent Gain	1912	1913	Per Cent Gain	1912	1913	Per Cent Gain
Not pruned, ..	4	4	449	5	5	512	3	4	392	3	2	457
Winter not cut back, ...	5	5	419	4	4	450	5	5	373	5	5	440
Summer only, .	3	1	452	1	3	389	1	1	491	4	3	477
Winter and summer, ...	1	3	412	3	2	411	4	3	431	1	1	393
Winter cut back, ...	2	2	431	2	1	416	2	2	494	2	4	390

Measurement of Circumference of Trunks of Trees at New Brunswick, 1913

At the close of the season, the circumference of the trunks of the trees was measured at a height of six inches above the ground, and these measurements are shown in table 31. The average circumference of all the trees, regardless of variety, was 7.24 inches, and there were 30 trees above the average. Row 8, Tree 2, an Elberta, was high tree for the variety and for all varieties, with a circumference of 9.25 inches. The low tree of this variety was Row 1, Tree 8, with a circumference of 6.00 inches. The average for the variety was 7.31 inches, 9 trees being above and 16 below the average.

TABLE 31

MEASUREMENT OF CIRCUMFERENCES
NEW BRUNSWICK, 1913

VARIETY	Tree No.	Row 1 NP	Row 2 WNCB	Row 3 W&S	Row 4 S	Row 5 WCB	Row 6 W&S	Row 7 S	Row 8 WNCB	Row 9 WCB	All Rows All Treatments
		Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
Elberta, ...	1	......	7.50	7.25	7.25	7.50	7.25	7.50	8.25	8.50	
	2	6.00	7.00	7.00	7.00	6.50	7.50	......	9.25	7.00	
	3	......	6.75	6.75	7.00	6.50	6.75	7.25	8.50	7.00	
	4	......	8.00	......	......	......	......	......	......	......	
Average, ...	.....	6.00	7.31	7.00	7.08	6.83	7.17	7.38	8.67	7.50	7.31
Stump, ...	4	......	......	8.00	7.00	6.25	......	7.25	7.00	7.00	
	5	8.50	7.50	7.50	7.00	7.75	6.75	6.75	7.25	8.50	
Average, ...	.....	8.50	7.50	7.75	7.00	7.00	6.75	7.00	7.13	7.75	7.33
Carman, ...	6	......	7.00	7.00	6.00	8.50	7.25	7.50	8.25	7.00	
	7	8.50	5.75	5.75	6.25	7.75	6.50	7.00	8.75	8.00	
	8	7.00	7.00	7.00	6.75	7.00	6.25	7.25	......	7.00	
Average, ...	.....	7.75	6.58	6.58	6.33	7.75	6.67	7.25	8.50	7.33	7.12
All Average,..	.....	7.50	7.06	7.03	6.78	7.22	6.89	7.21	8.18	7.50	7.24

Of the variety Stump, Row 1, Tree 5, and Row 9, Tree 5, each had a circumference of 8.50 inches, the largest for the variety. The tree having the smallest circumference was Row 5, Tree 4, with a circumference of 6.25 inches. Six trees were above and 9 trees below the average for the variety, 7.33 inches.

Carman had two trees which measured 5.75 inches; Row 2, Tree 7, and Row 3, Tree 7. This is the smallest circumference for the variety and for all three varieties. The largest Carman, Row 8, Tree 7, had a circumference of 8.75 inches. The average for this variety was 7.12, 9 trees being above and 16 below the average.

Table 32

Average of Circumferences by Treatments

New Brunswick, 1913

Variety	Not Pruned	Winter Not Cut Back	Winter Cut Back	Winter and Summer	Summer	All
	Inches	Inches	Inches	Inches	Inches	Inches
Elberta, ...	6.00	7.89	7.17	7.08	7.20	7.31
Stump, ...	8.50	7.25	7.38	7.42	7.00	7.33
Carman, ...	7.75	7.35	7.54	6.63	6.79	7.12
All, ...	7.50	7.38	7.36	6.96	6.98	7.24

When the average circumferences are classified according to treatment (table 32), the rank of the treatments, regardless of variety, is as follows:

		Inches
1.	Not pruned, ...	7.50
2.	Winter not cut back, ...	7.38
3.	Winter cut back, ...	7.36
4.	Summer only, ...	6.98
5.	Winter and summer, ...	6.96

This ranking agrees with the ranking as to circumference at the close of the first season. The rank by variety, however, is changed. In case of each of the three varieties the treatment which had first rank in 1912 retained its rank in 1913, viz., Elberta, "winter not cut back"; Stump, "not pruned"; Carman, "not pruned."

Per Cent Increase in Circumference During 1913

The per cent increase in circumference for each tree, row, and variety, is shown in table 33.

TABLE 33. PER CENT INCREASE IN

VARIETY		ROW 1			ROW 2			ROW 3			ROW 4		
		NP			WNCB			W&S			S		
		1912	1913	Gain	1912	1913	Gain	1912	1913	Gain	1912	1913	Gain
	Tree No.	Inches	Inches	Per Cent	Inches	Inches	Per Cent	Inches	Inches	Per Cent	Inches	Inches	Per Cent
Elberta.	1	....	....	...	3.31	7.50	127	3.37	7.25	115	3.50	7.25	107
	2	3.12	6.00	87	2.93	7.00	139	2.81	7.00	149	2.81	7.00	149
	3	....	....	...	2.18	6.75	210	3.00	6.75	125	3.12	7.00	124
	4	....	....	...	3.12	8.00	156	....	....	...	....	....	...
Average,	......	3.12	6.00	87	2.89	7.31	153	3.06	7.00	129	3.14	7.08	125
Stump,	4	....	....	...	....	....	...	....	....	...	2.93	7.00	139
	5	....	....	...	....	....	...	3.25	7.50	131	3.81	7.00	84
Average,	......	....	....	...	....	....	...	3.25	7.50	131	3.37	7.00	108
Carman,	6	....	....	...	2.50	7.00	180	2.68	7.00	161	2.56	6.00	134
	7	4.68	8.50	82	3.18	5.75	81	2.00	5.75	188	3.12	6.25	100
	8	3.75	7.00	87	3.00	7.00	133	3.00	7.00	133	2.93	6.75	130
Average,	......	4.22	7.75	84	2.89	6.58	128	2.56	6.58	157	2.87	6.33	121
All Average,	......	3.85	7.17	86	2.89	7.00	140	2.87	6.89	140	3.10	6.78	119

Circumference, New Brunswick, 1913

Row 5			Row 6			Row 7			Row 8			Row 9			All Rows		
WCB			W&S			S			WNCB			WCB			All Treatments		
1912	1913	Gain	1912	1913	Gain	1912	1913	Gain	1912	1913	Gain	1912	1913	Gain	1912	1913	Gain
Inches	Inches	Per Cent	Inches	Inches	Per Cent	Inches	Inches	Per Cent	Inches	Inches	Per Cent	Inches	Inches	Per Cent	Inches	Inches	Per Cent
3.75	7.50	100	3.81	7.25	90	3.75	7.50	100	4.31	8.25	91	3.87	8.50	120			
2.43	6.50	167	3.75	7.50	100	....	....	...	2.00	9.25	363	2.18	7.00	221			
3.06	6.50	112	2.81	6.75	140	2.93	7.25	147	3.37	8.50	152	3.18	7.00	120			
....	....	...	....	....	...	....	....	...	....	....	...	....	....	...			
3.08	6.83	122	3.46	7.17	107	3.34	7.38	121	3.23	8.67	169	3.08	7.50	144	3.14	7.31	133
3.81	6.25	64	....	....	...	3.50	7.25	107	3.37	7.00	108	3.37	7.00	108			
4.00	7.75	94	2.93	6.75	130	3.18	6.75	112	4.00	7.25	81	4.00	8.50	113			
3.91	7.00	79	2.93	6.75	130	3.34	7.00	110	3.69	7.13	93	3.69	7.75	110	3.51	7.17	104
3.68	8.50	131	3.37	7.25	115	3.12	7.50	140	4.31	8.25	91	2.56	7.00	173			
3.93	7.75	97	3.00	6.50	117	3.00	7.00	133	3.18	8.75	175	3.62	8.00	121			
2.87	7.00	144	2.62	6.25	139	3.50	7.25	107	....	....	...	2.75	7.00	155			
3.49	7.75	122	3.00	6.67	122	3.21	7.25	126	3.75	8.50	128	2.98	7.33	146	3.16	7.12	126
3.44	7.22	110	3.18	6.89	116	3.28	7.21	120	3.51	8.18	133	3.19	7.50	135	3.22	7.21	124

Table 34 shows the average per cent increase in circumference according to treatments.

TABLE 34

AVERAGE PER CENT INCREASE IN CIRCUMFERENCE ACCORDING TO TREATMENTS NEW BRUNSWICK, 1913

VARIETY	Not Pruned	Winter Not Cut Back	Winter Cut Back	Winter and Summer	Summer	All
	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
Elberta, ...	87	160	133	117	123	133
Stump, ...	..	93	94	130	109	104
Carman, ...	84	127	133	138	124	126
All, ...	86	137	122	128	119	124

It will be noted that the rank of the varieties in this table is: (1) Elberta; (2) Carman; (3) Stump. The rank as to total circumference was: (1) Stump; (2) Elberta; (3) Carman.

Actual and Per Cent Increase in Circumference and Gain in Twig Growth Compared on the Basis of Treatments

The rank of the various treatments for 1912 and 1913, as to actual measurement of circumference, compared with the per cent increase in circumference, is shown in table 35.

TABLE 35

RELATIVE RANK OF TREATMENTS, 1912 AND 1913, AND PER CENT INCREASE IN CIRCUMFERENCE OF TRUNKS, NEW BRUNSWICK

	All			Elberta			Stump			Carman		
	1912	1913	Per Cent Increase	1912	1913	Per Cent Increase	1912	1913	Per Cent Increase	1912	1913	Per Cent Increase
Not pruned, ..	1	1	86	3	5	87	*1	*1	*	1	1	84
Winter not cut back, ...	2	2	137	1	1	160	3	4	93	2	3	127
Winter cut back, ...	3	3	122	4	2	133	2	3	94	3	2	133
Winter and summer, ...	5	5	128	2	3	117	5	2	130	5	5	138
Summer only,..	4	4	119	5	4	123	4	5	109	4	4	124

* The measurement for Stump "not pruned" was made on a different tree each year.

Table 36 shows the rank of the various treatments for 1912 and 1913, as to actual measurement of twig growth, compared with the per cent gain in linear twig growth.

It will be noted that here, as at Vineland, the treatments rank the same when the actual measurements of twig growth and circumference are compared, varieties being disregarded. The varieties, however, show differences in rank as to treatments when compared on this basis.

TABLE 36

RELATIVE RANK OF TREATMENTS, 1912 AND 1913, AND PER CENT GAIN IN TWIG GROWTH, NEW BRUNSWICK

VARIETY	All			Elberta			Stump			Carman		
TREATMENT	1912	1913	Per Cent Gain	1912	1913	Per Cent Gain	1912	1913	Per Cent Gain	1912	1913	Per Cent Gain
Not pruned, ..	1	1	661	1	3	415	3	1	644	4	1	1107
Winter not cut back, ...	2	3	622	2	1	732	4	5	374	2	4	662
Winter cut back, ...	3	4	544	4	4	702	1	4	324	3	2	681
Winter and summer, ...	5	5	591	3	5	653	2	2*	350	5	5	732
Summer only,..	4	2	634	5	2	692	5	2*	572	1	3	434

* Of equal rank in 1913.

INCREASE IN CIRCUMFERENCE OF TREES OF VARYING VIGOR AT VINELAND

At the end of the first season, it was found that 55 trees were below and 42 trees were above the average in circumference. At the close of the second season, these same trees were averaged in these two groups. The computation showed that, while the trees that were in the "above" class at the end of 1912 still had the larger averages, the trees in the "below" class in 1912 made the greater per cent increase in trunk circumference, averaging 32 per cent more increase. This is regardless of variety.

Table 37 gives these data for all three varieties combined and for each variety. This adds more evidence to that previously given, to the effect that trees that make a relatively small growth one year may make a relatively large growth the next year, other things being equal.

TABLE 37

PER CENT INCREASE IN CIRCUMFERENCE, IN 1913, OF TREES ABOVE AND BELOW THE AVERAGE IN 1912, VINELAND, 1913

VARIETY	BELOW AVERAGE				ABOVE AVERAGE			
	No.	Average Circumference 1912	Average Circumference 1913	Gain	No.	Average Circumference 1912	Average Circumference 1913	Gain
		Inches	Inches	Per cent		Inches	Inches	Per cent
All,	55	3.49	7.73	121	42	4.43	8.38	89
Stump,	18	3.78	7.78	106	17	4.55	8.53	88
Carman,	17	3.39	7.86	132	19	4.40	8.46	92
Elberta,	13	3.26	7.28	123	13	4.10	8.10	98

TABLE 38

COMPARISON OF GAINS IN CIRCUMFERENCE BETWEEN GROUPS OF TREES OF VARYING VIGOR, VINELAND, 1913

SIZE OF TREE	No.	Average Circumference 1912	Average Circumference 1913	Actual Gain	Per Cent Gain
Inches		Inches	Inches	Inches	
2.12–3.00	5	2.65	7.40	4.75	179
3.12	3	3.12	8.17	5.05	162
3.25	3	3.25	8.00	4.75	146
3.37	7	3.37	7.53	4.16	124
3.50	6	3.50	7.92	4.42	126
3.62 & 3.66	6	3.63	7.33	3.77	106
3.75	12	3.75	7.83	4.08	109
3.88	8	3.88	7.88	4.00	103
4.00	8	4.00	7.88	3.88	97
4.12	6	4.12	7.96	3.84	93
4.25	9	4.25	8.81	4.56	107
4.37	7	4.37	8.61	4.24	97
4.50–4.62	4	4.56	8.81	4.25	93
4.75–4.88	7	4.81	8.54	3.73	78
5.00–5.25	6	5.08	9.42	4.34	85

TABLE 39

COMPARISON OF TREES ABOVE AND BELOW THE AVERAGE IN CIRCUMFERENCE IN 1912, NEW BRUNSWICK, 1913

VARIETY	BELOW AVERAGE				ABOVE AVERAGE			
	No. Trees	Average Circumference 1912	Average Circumference 1913	Gain	No. Trees	Average Circumference 1912	Average Circumference 1913	Gain
		Inches	Inches	Per cent		Inches	Inches	Per cent
Elberta,	14	2.75	7.12	159	11	3.63	7.64	111
Stump,	7	3.24	7.04	121	5	3.92	7.35	87
Carman,	15	2.78	6.73	142	10	3.72	7.70	107
All,	35	2.83	6.59	145	27	3.61	7.59	114

Still further substantiating evidence is shown in table 38. The grouped trees of the same circumference are arranged in groups og about ⅛ inch difference, from 2.12 inches to 5.25 inches. The per cent gain was greatest with the smallest trees. As the trees increased in circumference, there was a general dcrease in the percentage of increase.

INCREASE IN CIRCUMFERENCE OF TREES OF VARYING VIGOR AT NEW BRUNSWICK

Table 39 shows the average circumference for 1912 and 1913, and the per cent increase in circumference, for the trees at New Brunswick that were below the average and those that were above the average circumference in 1912. In every case, the trees that were below the average have made the greatest per cent increase in circumference; this in spite of the fact that the average girth in both years is below the average. Certain of the individual trees in the "below" group have made a growth that would place them above the average in 1913, but the majority remain below.

TABLE 40

COMPARISON OF TREES OF VARYING VIGOR ON THE BASIS OF INCREASE IN CIRCUMFERENCE, NEW BRUNSWICK

Circumference	No. Trees	Average Circumference 1912	Average Circumference 1913	Actual Gain	Per Cent Gain
Inches		Inches	Inches	Inches	
2.00–2.50	7	2.26	6.89	4.63	206
2.51–2.75	4	2.68	6.81	4.13	155
2.76–3.00	13	2.92	6.90	3.98	136
3.01–3.25	11	3.15	7.00	3.85	122
3.26–3.50	9	3.41	7.36	3.95	116
3.51–3.75	6	3.72	7.58	3.86	104
3.76–4.00	8	3.90	7.53	3.63	93
4.01–5.00	3	4.43	8.33	3.90	88

This fact is brought out more clearly again in table 40, in which is shown a tabulation on the basis of the circumference in 1912, in groups of one-half or one-fourth inch variations. The smallest trees showed the greatest per cent increase in circumference. As the trees increase in size, the per cent increase in circumference diminishes.

RELATION OF INCREASE IN TRUNK CIRCUMFERENCE TO INCREASE IN TWIG GROWTH AT VINELAND

Since both twig growth and circumference are being determined in these experiments, it is of interest to note any relation that may apparently exist between the two. Table 41 shows the number of inches of twig growth made during 1913 per 1 inch gain in circumference of the trunk, for each individual tree.

TABLE 41

RATIO OF ONE INCH INCREASE IN CIRCUMFERENCE TO INCREASE IN TWIG GROWTH, VINELAND, 1913

Pruning Treatment	Row	Variety	Tree 2	Tree 3	Tree 4	Tree 5	Row Average	Plot Average
Not pruned	1	Stump, ...	925	...	1055	942	909	...
	2	Carman, ...	1273	1861	618	572	970	...
	3	Elberta, ...	...	...	...	...	...	940
Winter not cut back	4	Stump, ...	998	528	...	974	842	...
	5	Carman, ...	966	484	702	938	749	...
	6	Elberta, ...	1068	439	990	646	781	784
Summer	7	Stump, ...	...	911	937	1215	1016	...
	8	Carman, ...	659	836	...	1394	938	...
	9	Elberta, ...	1211	596	1022	599	853	924
Winter and summer	10	Stump	1211	810	1358	895	1078	...
	11	Carman, ...	1053	788	975	986	956	...
	12	Elberta, ...	...	...	714	691	788	971
Winter cut back	13	Stump, ...	1269	981	1223	1104	1147	...
	14	Carman, ...	...	876	805	690	795	...
	15	Elberta, ...	786	547	811	731	715	879
Winter not cut back	16	Stump, ...	...	1044	1283	1359	1206	...
	17	Carman, ...	1036	716	666	439	766	...
	18	Elberta, ...	...	501	...	688	583	874
Not pruned	19	Stump, ...	...	1179	1265	737	1030	...
	20	Carman, ...	...	...	992	951	972	...
	21	Elberta, ...	...	...	...	...	...	1005
Winter and summer	22	Stump, ...	1527	1098	1146	1285	1270	...
	23	Carman, ...	1273	849	912	990	1013	...
	24	Elberta, ...	1128	...	1257	1750	1325	1181
Winter cut back	25	Stump, ...	1061	678	1385	782	992	...
	26	Carman, ...	1318	621	1191	1048	1001	...
	27	Elberta, ...	1205	397	765	1249	885	960
Summer	28	Stump, ...	1034	1306	1197	1186	1172	...
	29	Carman.	1666	826	1289	866	1142	...
	30	Elberta, ...	...	...	970	962	966	1119

It may be noted that the average growth per 1 inch gain in circumference for all the trees was 960 inches. The range, however, was from 397 an 1861 inches. The average Stump was 1069 inches, for Carman 931 inches and for Elberta 853 inches. Some variation between varieties is to be expected, of course.

There is great variation, however, between different individuals of the same variety. The range in Stump was from 528 (Row 4,

Tree 2) to 1527 inches (Row 22, Tree 2). The range in Carman was from 484 (Row 5, Tree 3) to 1861 inches (Row 2, Tree 3). The range in Elberta was from 397 (Row 27, Tree 3) to 1750 inches (Row 24, Tree 5).

In general, the widest ratio occurred with trees which made a very large growth. For example, Row 26, Tree 2, with a total growth of 6088 inches, has a ratio of twig growth to circumference of 1318 inches. Row 29, Tree 2, with a total twig growth of 6883 inches, has a ratio of 1666 inches. In contrast to this, Row 6, Tree 3, with a twig growth of 1466 inches, has a ratio of 509 inches, and Row 17, Tree 5, with a total growth of 1045 inches, has a ratio of 349 inches. It should be noted, however, that some trees which made a large growth have a relatively low ratio. Row 14, Tree 4, made a growth of 5137 inches and has a ratio of 805 inches. Row 20, Tree 5, made a growth of 4515 inches and has a ratio of 951 inches. Some trees which made a relatively small growth also have a relatively wide ratio. For example, Row 2, Tree 3, made a total growth of only 2569 inches and yet had a ratio of 1861 inches. Row 7, Tree 5, made a growth of 3793 inches and has a ratio of 1215 inches.

There might be several factors which would result in a different ratio between trees making about the same amount of twig growth, especially in a pruning experiment. It is a well known fact that, if one desires to develop a strong, vigorous trunk on a young shade tree, the side branches, especially those low on the trunk, should be allowed to develop for a time. Or, in other words, the development of branches on the trunk tends to make it larger in circumference than if they are kept pruned off. A peach tree which develops one or two large branches low down on the trunk might make a relatively large gain in circumference in comparison with a tree having a longer trunk and whose twig growth is made in an upward direction. It might be expected also that the removal of suckers and shoots from the trunk of a tree in summer pruning would tend to make a wide ratio in comparison with any treatment which allowed such growths to continue during the season.

Some indication of this occurs in the results for 1913, since the summer-pruned treatments generally show a wide ratio. These trees also made a relatively large average twig growth, so that this interpretation is not clearly demonstrated.

Relation of One Inch Increase in Circumference to Increase in Twig Growth by Treatments

Where all varieties are averaged the "summer and winter" treatment shows the largest ratio, 1088. The "summer only" treatment is second with a ratio of 1016. The smallest ratio is shown by the "winter not cut back" treatment, being 822. The "winter cut back" is the next larger with a ratio of 971.

TABLE 42. RATIO OF ONE INCH INCREASE IN CIRCUMFERENCE TO

VARIETY	NOT PRUNED					WINTER NOT CUT BACK					SUMMER				
	Plot	No. Trees	Average Growth	Average Increase Circumference	Ratio	Plot	No. Trees	Average Growth	Average Increase Circumference	Ratio	Plot	No. Trees	Average Growth	Average Increase Circumference	Ratio
			Inches	Inches				Inches	Inches				Inches	Inches	
All, ...	1	7	3359	3.57	940	2	11	3367	3.66	784	3	10	3478	3.77	924
	7	5	4523	4.50	1005	6	9	3388	3.88	874	10	10	4818	4.30	1119
Total, ...	...	12	3844	4.06	971	...	20	3377	4.11	822	..	20	4148	4.04	1016
Stump, ...	1	3	3672	4.04	907	2	3	3543	4.21	842	3	3	3382	3.33	1016
	7	3	4337	4.21	1030	6	3	4825	4.00	1206	10	4	4945	4.22	1172
Total, ...	...	6	4004	4.12	970	...	6	4184	4.12	1020	...	7	4285	3.94	1114
Carman, .	1	4	3124	3.22	970	2	4	3429	4.98	748	3	3	3947	4.21	938
	7	2	4802	4.92	972	6	4	2802	3.66	766	10	4	5074	4.44	1142
Total, ...	...	6	3683	3.80	971	...	8	3265	4.32	756	..	7	4591	4.34	1058
Elberta, .	1	......	....	....	....	2	4	2874	3.68	781	3	4	3199	3.75	853
	7	......	....	....	....	6	2	2407	4.13	583	10	2	4050	4.20	964
Total, ...	...	......	....	....	....	...	6	2718	3.83	710	...	6	3483	3.89	852

If we make comparisons between treatments on the basis of variety, we note that the widest ratio and the second widest occur in the "winter and summer" and the "summer only" treatments in the case of Stump and Elberta. With the variety of Carman, the "summer" treatment ranks first, with "winter and summer" a close second. The lowest ratio occurs in the "winter not cut back" treatment in the case of Carman and Elberta, and in the "not pruned" treatment with Stump. Since all growing

shoots and suckers were removed from the trunks in the summer-pruned treatment, we might expect them to show the widest ratio.

The average gain in inches of twig growth per inch in circumference for all varieties was 960. The average for Stump was 1069, the average for Carman, 931, and the average for Elberta, 853. This indicates a considerable difference between the varieties Stump and Elberta.

Increase in Twig Growth According to Treatments, Vineland

Summer and Winter					Winter Cut Back					All			
Plot	No. Trees	Average Growth	Average Increase Circumference	Ratio	Plot	No. Trees	Average Growth	Average Increase Circumference	Ratio	No. Trees	Average Growth	Average Increase Circumference	Ratio
		Inches	Inches				Inches	Inches			Inches	Inches	
4	10	3873	3.99	971	5	11	3787	4.31	879				
8	11	3188	3.55	1181	9	12	4508	4.69	966				
...	21	4038	3.75	1088	...	23	4168	4.50	924	96	3929	4.09	960
4	4	4347	4.03	1078	5	4	4375	3.82	1145				
8	4	4286	3.37	1260	9	4	4550	4.59	992				
...	8	4316	3.70	1200	...	8	4463	4.20	1061	35	4265	3.99	1069
4	4	3709	3.88	956	5	3	3876	4.88	795				
8	4	3961	3.91	1013	9	4	5132	5.13	1001				
...	8	3835	3.89	986	..	7	4595	5.02	916	36	3978	4.28	931
4	2	3254	4.13	788	5	4	3131	4.38	715				
8	3	4361	3.29	1325	9	4	3841	4.35	864				
...	5	3918	3.63	1079	...	8	3486	4.36	799	25	3387	3.98	853

The averages of the various varieties, however, do not show the range of variation in the ratio of twig growth to circumference. If we examine the results on the basis of each individual tree we will note that the range in twig growth per inch of circumference varies from 369 to 1230 inches with Stump, from 304 to 1411 inches with Carman, and from 266 to 1485 inches with Elberta, which is also the extreme for all varieties.

It is of interest to note the relation between a large amount of twig growth and the size of the ratio. In general, a large amount of twig growth per tree also indicates a wide ratio of growth per 1 inch increase in trunk circumference. For example, Row 2, Tree 2, with a total growth of 5728 inches, had a ratio of 1130. Row 16, Tree 4, with a growth of 5778 inches, had a ratio of 1059. In contrast to these Row 2, Tree 4, with a total growth of 2627 inches, had a ratio of 385, and Row 10, Tree 3, with a growth of 2832 inches, had a ratio of 644. Yet, when we note the behavior of many individual trees it is evident that some trees that made a very large total twig growth had a relatively low ratio. For example, Row 26, Tree 3, made a growth of 4189 inches, but had a ratio of 846. In other words, two trees might show an inch gain in circumference and yet vary greatly in the total amount of twig growth made. This suggests that the character and location of the new twig growth is a factor in the relation of twig growth to gain in circumference of the trunk.

The ratio between the number of inches of twig growth and the weight of the twigs for any given variety is probably fairly constant where a large amount is measured and weighed. No weights were taken of wood growth pruned off during the first few years of the experiment, but this factor is to be checked in later years.

It is quite probable, too, that if the branches that are low down on the trunk of the tree make a considerable growth, the ratio of increase in trunk circumference to increase in twig growth will be narrower than if most of the growth is made by branches a considerable distance from the ground. A study of the different pruning treatments furnishes some evidence on this point. Table 42 gives the ratios between twig growth and 1 inch gain in circumference of trunks for the various pruning treatments.

RELATION OF INCREASE IN TRUNK CIRCUMFERENCE TO INCREASE IN TWIG GROWTH, AT NEW BRUNSWICK

The ratio of the gain in inches of twig growth to each inch increase in circumference is shown in table 43. The average ratio for all varieties was 738, as compared with 960 at Vineland. The ratio for Stump was 822 at New Brunswick and 1069 at

Vineland. Carman gave a ratio of 744 at New Brunswick and 931 at Vineland, and Elberta 699 and 853, respectively. These ratios are interesting. It was noted previously that the average amount of twig growth made by the trees at New Brunswick was considerably less than that made at Vineland. Nevertheless, the ratios apparently indicate a definite relation between the amount of twig growth and the increase in trunk circumference.

TABLE 43

RATIO OF ONE INCH INCREASE IN CIRCUMFERENCE TO INCREASE IN TWIG GROWTH, NEW BRUNSWICK

VARIETY	Tree No.	Row 1 NP	Row 2 WNCB	Row 3 W&S	Row 4 S	Row 5 WCB	Row 6 W&S	Row 7 S	Row 8 WNCB	Row 9 WCB	All Rows All Treatments
Elberta, ...	1	...	656	785	810	704	730	792	1030	922	
	2	828	752	526	770	362	838	...	600	527	
	3	...	430	622	844	718	596	668	863	687	
	4	...	720	...	...	...	...	...	...	...	
Average, ...	.....	828	606	632	810	584	719	726	786	711	699
Stump, ...	4	...	...	...	735	690	...	866	726	746	
	5	...	...	653	1035	785	710	868	900	1116	
Average, ...	.....	...	...	653	867	748	710	867	809	950	822
Carman, ...	6	...	398	578	589	746	900	849	978	638	
	7	1223	1172	463	960	784	688	704	695	959	
	8	954	514	753	838	544	569	935	...	553	
Average, ...	.....	1099	620	603	736	692	723	828	812	726	744
All Average, ...	.....	1016	612	622	798	662	720	807	799	774	738

The evidence at New Brunswick also points to the fact that in general the trees which made the largest twig growth also gave the largest ratio to increase in circumference. Row 1, Tree 7, made a growth of 4670 inches, a ratio of 1223; Row 8, Tree 1, made a growth of 4060 inches, a ratio of 1030. In contrast to these, Row 8, Tree 2, made a growth of 4347 inches, a ratio of 600.

When these ratios are compared on a basis of treatment (table 44) it is found that the "not pruned" treatment has the widest average ratio, while at Vineland that of the "not pruned" was one of the lowest. It was suggested at the beginning that the location of this plot at the College Farm might have some influence on the growth.

Excluding this treatment, the "summer only" treatment has the widest ratio for all, regardless of variety and for each variety. At Vineland, the "summer only" treatment ranked second for all, variety disregarded and for Elberta alone, and first in the case of Carman. On the other hand, the "summer and winter" treatment at Vineland ranked first for all, disregarding varieties, as well as for Stump and Elberta, and second for Carman. At New Brunswick this treatment is fifth when the varieties are considered together, and also in the case of Carman, and fourth in the case of Elberta and Stump.

TABLE 44

RATIO OF ONE INCH INCREASE IN CIRCUMFERENCE TO INCREASE IN TWIG GROWTH BY TREATMENTS, NEW BRUNSWICK

VARIETY	NP	WNCB	WCB	W&S	S	ALL
Elberta, ...	828	693	653	674	776	699
Stump, ...	....	809	854	680	867	822
Carman, ...	1099	709	710	660	786	744
All, ...	1016	712	722	669	804	738

DORMANT SEASON PRUNING AT VINELAND, MARCH, 1914

Trees receiving the "winter and not cut back," the "winter cut back" and the "winter and summer" treatments were pruned during March, 1914. The pruning treatments were carried out as planned and outlined on page 6. Table 45 shows the amount of total growth made by each tree, the amount pruned off, and the percentage of total growth pruned off. The summer prunings are included in the totals of amount of growth pruned off in the case of Plots 3, 4, 8 and 10.

Table 46 shows the average amount of growth made by each plot and treatment, and the amount and percentage of twig growth pruned off. The average amount of growth pruned off from each tree, regardless of variety and treatment, was 2245 inches or 56 per cent. This varies somewhat with varieties as well as with treatments as follows: Stump 2576 inches, or 59 per cent; Carman 2146 inches, or 53 per cent; and Elberta 2009 inches, or 56 per cent. It may be noted that the amount of pruning was in proportion to the amount of twig growth. Some variation is also due to the habit of growth of the variety. Stump

TABLE 45

TABULATION OF PRUNING, INCLUDING SUMMER PRUNING, VINELAND, 1913

PLOT	Row	TREE 2 Growth	TREE 2 Pruned	TREE 2 Per Cent Pruned	TREE 3 Growth	TREE 3 Pruned	TREE 3 Per Cent Pruned	TREE 4 Growth	TREE 4 Pruned	TREE 4 Per Cent Pruned	TREE 5 Growth	TREE 5 Pruned	TREE 5 Per Cent Pruned	AVERAGE Growth	AVERAGE Pruned	AVERAGE Per Cent Pruned	PLOT AVERAGE Growth	PLOT AVERAGE Pruned	PLOT AVERAGE Per Cent Pruned
		Inches	Inches		Inches	Inches		Inches	Inches		Inches	Inches		Inches	Inches		Inches	Inches	
	4	4739	2149	45	2110	1162	55	....	....	..	3780	1571	42	3543	1627	46			
2, ...	5	4721	2003	42	2781	563	20	3775	1601	42	3637	1526	41	3729	1423	38			
	6	3076	1396	45	1466	733	50	4208	2084	49	2746	963	35	2874	1294	45	3367	1432	43
	7	....	....	..	2731	1324	48	3623	1105	31	3793	1819	48	3382	1416	42			
3, ...	8	3547	1101	31	2715	1197	44	5543	2314	42	5578	2888	52	4346	1875	43			
	9	4844	2680	55	2233	1243	56	3324	1333	40	2396	1186	50	3199	1611	50	3666	1654	45
	10	4240	2542	60	2832	1250	44	6288	4527	72	4026	2098	52	4347	2604	60			
4, ...	11	4213	2240	53	2653	923	35	4144	2315	56	3825	1545	40	3709	1746	47			
	12	....	....	..	....	....	..	3481	2314	66	3027	1598	53	3254	1956	60	3873	2135	55
	13	4925	3507	71	3431	2089	61	4586	3495	76	4559	2903	64	4375	2999	69			
5, ...	14	....	....	..	3825	2504	66	5137	3583	70	2676	909	34	3879	2332	60			
	15	3343	2530	76	2665	1566	56	3956	3382	86	2558	1676	66	3131	2289	73	3696	2559	68
	16	4707	2522	54	4960	1441	29	5778	3710	64	3737	2041	55	4796	2429	51			
6, ...	17	5060	2365	47	2603	1194	46	2499	1626	65	1045	719	69	2802	1476	53			
	18	4931	2902	59	2315	1247	54	....	....	..	2498	1047	42	3248	1732	53	3648	1892	52
	22	5530	3930	71	3428	2116	62	4010	3153	79	4177	2530	61	4286	2932	68			
8, ...	23	5410	3630	67	3182	1782	56	3539	2555	72	3714	1898	51	3961	2466	62			
	24	4514	3676	82	4235	2492	59	4402	2909	66	4166	1914	46	4329	2748	64	4192	2715	65
	25	4511	3306	73	2964	1952	66	7108	5954	84	3618	2729	75	4550	3485	77			
9, ...	26	6088	3696	61	4189	2796	67	5657	4376	77	4592	3631	79	5132	3625	71			
	27	4819	3615	75	1885	1293	69	3350	1960	59	5311	3051	58	3841	2480	65	4508	3180	71
	28	5046	2636	52	4899	2590	53	5233	2935	56	4603	2194	48	4945	2589	52			
10, ...	29	6883	3469	50	3922	1878	48	5480	1880	34	4010	1810	45	5074	2259	44			
	30	6746	3132	46	2810	1247	44	3530	1528	43	4570	1575	34	4414	1871	42	4811	2240	47
Average, ...	......	4852	2811	58	3080	1591	52	4484	2756	61	3696	1909	52	....	....	..	....	....	..

TABLE 46

TABULATION OF PRUNING, INCLUDING SUMMER PRUNING, ACCORDING TO TREATMENTS, VINELAND, 1913

VARIETY	ALL				STUMP				CARMAN				ELBERTA			
TREATMENT	Plot	Growth	Pruned	Per Cent Pruned	Plot	Growth	Pruned	Per Cent Pruned	Plot	Growth	Pruned	Per Cent Pruned	Plot	Growth	Pruned	Per Cent Pruned
		Inches	Inches			Inches	Inches			Inches	Inches			Inches	Inches	
Winter not cut	2	3367	1432	43	2	3543	1627	46	2	3729	1423	38	2	2874	1294	45
back, ...	6	3648	1892	52	6	4796	2429	51	6	2802	1476	53	6	3248	1732	53
Total, ...		3508	1662	47		4259	2085	49		3265	1450	44		3034	1482	49
Summer, ...	3	3666	1654	45	3	3382	1416	42	3	4346	1875	43	3	3199	1611	50
	10	4811	2240	47	10	4945	2589	52	10	5074	2259	44	10	4414	1871	42
Total, ...		4263	1959	46		4275	2086	49		4710	2067	44		3807	1741	46
Winter and sum-	4	3873	2135	55	4	4347	2604	60	4	3709	1746	47	4	3254	1956	60
mer, ...	8	4192	2715	65	8	4286	2932	68	8	3961	2466	62	8	4329	2748	64
Total, ...		4047	2452	61		4316	2768	64		3835	2111	55		3971	2484	63
Winter cut back, ..	5	3696	2559	68	5	4375	2999	69	5	3879	2332	60	5	3131	2289	73
	9	4508	3180	71	9	4550	3485	77	9	5132	3625	71	9	3841	2480	65
Total, ...		4163	2891	69		4463	3242	72		4595	3071	66		3486	2384	69
All, ...		4000	2245	56		4332	2576	59		4086	2146	53		3566	2009	56

produces many twigs while Carman develops comparatively few. An analysis of the results according to treatments shows the following facts.

The "winter cut back" treatment resulted in the most severe pruning with an average cut in twig growth of 2891 inches, or 69 per cent. The "winter and summer" treatment was second with an average total twig growth removed of 2452 inches, or 61 per cent. The "winter not cut back" was third in the proportion pruned off with 47 per cent, but was last in amount pruned off with a total of 1662 inches. The "summer only" treatment was last in the proportion pruned off with 46 per cent, but third in amount pruned off, or 1959 inches. One principal object of the summer pruning was to reduce the amount of dormant-season pruning. It may be noted that in the "summer and winter treatment" the winter pruning amounted to an average of 1194 inches, while the winter pruning in the "winter-pruned and cut back" treatment amounted to an average of 2891 inches. The summer pruning apparently reduced the winter pruning about one-half.

The pruning was done with an ideal in mind of the type of pruning to be developed, so it is of interest to note that the percentages show that about one-half to two-thirds of the previous season's wood growth was actually removed. No conclusions are drawn at this time as to the advisability of such a practice, however.

PER CENT OF GROWTH REMOVED BY THINNING AND BY "CUTTING BACK" IN PRUNING TREATMENTS "WINTER CUT BACK" AND "SUMMER AND WINTER" AT VINELAND

In order to show what proportion of the growth removed in pruning was done in the "cutting back" process in the above-mentioned treatments, measurements were made of the wood removed in thinning and also of the "clippings." Table 47 gives the details of these measurements for each individual tree.

The largest total amount of clippings made from any Stump tree in the "winter and summer treatment" was 629 inches, while the smallest amount was 124 inches. The largest total amount

Table 47

Tabulation of Prunings: Amounts Thinned and Amounts Clipped, Vineland, 1913

Tree	Plot 4, Winter and Summer									Plot 8, Winter and Summer								
	Stump, Row 10			Carman, Row 11			Elberta, Row 12			Stump, Row 22			Carman, Row 23			Elberta, Row 24		
	Thinned	Clipped	Total	Thinned	Clipped	Total	Thinned	Clipped	Total	Thinned	Clipped	Total	Thinned	Clipped	Total	Thinned	Clipped	Total
	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
2, ...	1006	260	1266	1146	110	1256	....	....	....	2346	243	2589	1923	243	2166	1693	160	1853
3, ...	343	174	517	321	114	435	....	....	....	1137	124	1261	591	135	726	1352	204	1556
4, ...	2551	629	3180	1333	293	1626	1280	174	1454	1392	237	1629	1465	157	1622	1542	298	1840
5, ...	781	257	1038	494	216	710	351	65	416	1018	174	1192	177	166	343	709	126	835
Average, ...	1170	330	1500	824	183	1007	816	120	935	1473	195	1668	1039	175	1214	1324	197	1521
Plot Average, ..	....	....	....	961	229	1190	....	....	....	....	....	....	1279	189	1468	....	....	....

Tree	Plot 5, Winter Cut Back									Plot 9, Winter Cut Back								
	Stump, Row 13			Carman, Row 14			Elberta, Row 15			Stump, Row 25			Carman, Row 26			Elberta, Row 27		
	Thinned	Clipped	Total	Thinned	Clipped	Total	Thinned	Clipped	Total	Thinned	Clipped	Total	Thinned	Clipped	Total	Thinned	Clipped	Total
	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
2, ...	3168	339	3507	....	....	....	2346	184	2530	3103	203	3306	3270	426	3696	3341	274	3615
3, ...	1942	147	2089	2300	204	2504	1483	83	1566	1722	230	1952	2626	170	2796	1140	153	1293
4, ...	3340	155	3495	3396	187	3583	3263	119	3382	5613	341	5954	4145	231	4376	1778	182	1960
5, ...	2679	224	2903	739	170	909	1388	288	1676	2487	242	2729	3245	386	3631	2745	306	3051
Average, ...	2782	216	2999	2145	187	2332	2120	169	2289	3231	254	3485	3322	303	3625	2251	229	2480
Plot Average, ..	....	....	....	2368	191	2559	....	....	....	....	....	....	2935	262	3196	....	....	....

of clippings made from any Carman tree in the same treatment was 293 inches and the smallest 110, and the largest total amount from an Elberta was 298 and the smallest 65 inches.

The largest total amount of clippings made from any Stump tree in the "winter cut back" treatment was 341 inches and the smallest 147 inches. The largest total amount of clippings made from any Carman tree in the same treatment was 426 inches and the smallest 170 inches. The largest total amount of clippings made from any Elberta tree in this treatment was 306 inches and the smallest 83 inches.

TABLE 48

SUMMARY OF PRUNING: AMOUNTS THINNED AND AMOUNTS CUT BACK ACCORDING TO TREATMENTS

VINELAND, 1913

	WINTER AND SUMMER*					WINTER CUT BACK				
VARIETY	Total	Thinned		Clipped		Total	Thinned		Checked	
	Inches	Inches	Per cent	Inches	Per cent	Inches	Inches	Per cent	Inches	Per cent
Stump, ...	1584	1322	83	262	17	3242	3007	93	235	7
Carman, ...	1111	931	84	179	16	3091	2817	92	253	8
Elberta, ...	1326	1155	87	171	13	2384	2186	92	199	8
All, ...	1341	1134	85	207	15	2891	2663	92	228	8

* This refers only to the pruning which was done in the winter.

The average amount of growth thinned out and "cut back" by treatment in the winter pruning is given in table 48. The percentage of the twig growth which was removed in the "cutting back" process in the "winter and summer" treatments, regardless of variety, was 15 per cent, while in the "winter cut back" treatments it was 8 per cent. The greater percentage of clipping in the former treatment is probably due to the increased number of shoots developed as a result of the summer pinching. The "winter cut back" treatment generally requires rather severe thinning previous to clipping and this further reduces the number of shoots to be so treated. It may be noted that the actual amount of twig growth removed in the "cutting back" process in these experiments has not been very great thus far.

EFFECT OF SUMMER PRUNING DURING 1913 UPON TOTAL GROWTH AT VINELAND

There are no indications that the summer pruning as practiced in these experiments in 1913 checked growth or decreased vigor since the "summer only" treatment made the best average total

TABLE 49. RECORD OF PER CENT OF GROWTH PRUNED OFF

VARIETY	Tree No.	Row 2			Row 3			Row 4			Row 5		
		WNCB			W & S			S			WCB		
		Growth	Pruned		Growth	Pruned		Growth	Pruned		Growth	Pruned	
		Inches	Inches	Per Cent	Inches	Inches	Per Cent	Inches	Inches	Per Cent	Inches	Inches	Per Cent
Elberta, ...	1	2774	1468	53	3042	2659	87	3077	1046	34	2639	1903	72
	2	3062	1770	58	2205	1816	82	3224	1235	38	1470	1272	87
	3	....	....	..	2222	1240	56	3276	1639	50	2472	1639	56
	4	2939	1665	57	....	....	..	....	....	..	....	....	..
Average,	.....	2925	1634	56	2490	1905	77	3192	1307	41	2194	1605	73
Stump, ...	4	....	....	..	3034	2228	73	2991	1236	41	1684	1118	66
	5	2130	1227	53	2774	1962	71	3302	1559	47	2944	2057	70
Average,	.....	2130	1227	53	2904	2095	72	3147	1398	44	2314	1588	69
Carman, ...	6	1796	857	48	2495	1500	60	2027	615	30	3594	3001	84
	7	3013	1170	39	1734	1109	64	3005	1067	36	3000	1859	62
	8	2052	1486	72	3051	1884	62	2620	1053	40	2248	1564	70
Average,	.....	2287	1171	51	2427	1498	62	2551	912	36	2947	2141	73
All Average,	.....	2538	1378	54	2570	1800	70	2940	1181	40	2506	1802	72

twig growth of all the treatments and also the greatest average gain in trunk circumference. As to percentage gain in twig growth it also ranked first in 1913, and was third in per cent gain in trunk circumference.

These results are presented as a preliminary report. No definite conclusions are drawn at this point as to the general effects of the summer pruning of peaches.

TIME REQUIRED FOR PRUNING AT VINELAND

In an economic consideration of pruning, the time element is an important factor. In order to arrive at the economic value

of the various systems of pruning practiced in this experiment, the actual time required to prune the trees was recorded.

The system that required the greatest time for pruning was the "summer and winter" treatment. Trees receiving this treatment were given one pruning in June and another during the dormant season. The average time in minutes and seconds required to prune each tree was as follows:

DURING THE SEASON OF 1913–14, NEW BRUNSWICK

Row 6			Row 7			Row 8			Row 9			All Rows		
W & S			S			WNCB			WCB			All Treatments		
Growth	Pruned		Growth	Pruned		Growth	Pruned		Growth	Pruned		Growth	Pruned	
Inches	Inches	Per Cent	Inches	Inches	Per Cent	Inches	Inches	Per Cent	Inches	Inches	Per Cent	Inches	Inches	Per Cent
2513	1070	43	2971	907	31	4060	2278	56	4274	3564	83			
3141	2254	72	4107	1426	35	4347	2153	50	2539	2207	87			
2347	1427	61	2886	365	13	4425	2831	64	2624	2016	77			
....	....	..	....	....	..	....	....	..	....	....	..			
2667	1584	59	3321	899	27	4277	2421	57	3149	2596	83	3027	1744	58
4120	2804	68	3248	779	24	2632	1143	43	2709	1518	56			
2710	1598	59	3097	681	22	2931	2107	72	5020	3637	72			
3415	2201	64	3173	730	23	2782	1625	58	3865	2578	67	3022	1710	57
3488	2201	63	3717	690	18	3854	2468	64	2831	1937	68			
2497	1445	60	2818	487	17	3869	2074	54	4312	3485	81			
2064	1078	52	3506	776	22	2648	1703	64	2350	1648	70			
2653	1575	59	3347	651	19	3457	2082	60	3164	2357	74	2854	1548	54
2849	1735	61	3294	764	23	3596	2095	58	3332	2502	75	2960	1661	56

	Summer	*Winter*	*Total*
Stump, ...	2.45*	2.45	5.30
Carman, ...	2.00	2.35	4.35
Elberta, ...	2.10	3.15	5.25

The "summer only" treatment required the next greatest amount of time, as follows.

Stump, ...	5.30
Carman, ...	6.06
Elberta, ...	3.30

* The decimal point marks the division between minutes and seconds.

The "winter cut back" treatment was third in time consumed, the averages being:

Stump,	4.49
Carman,	4.30
Elberta,	3.15

The "winter not cut back" treatment required the least amount of time, averaging per tree as follows:

Stump,	3.23
Carman,	2.15
Elberta,	2.34

The greatest amount of growth was removed from the "winter cut back" treatment, with "winter and summer" second, "summer only" fourth. Thinning in summer requires more time, because of the interference of the foliage.

DORMANT SEASON PRUNING AT NEW BRUNSWICK, FEBRUARY AND MARCH, 1914

Trees receiving the "winter and not cut back," the "winter cut back," and the "winter and summer" treatments were pruned during February and March, 1914, as outlined on page 6. The pruning record for each tree is shown in table 49. Here is given the total twig growth for 1913, as well as the amount of growth pruned off (including the summer pruning in the case of plots 3, 4, 6 and 7), and the per cent of total growth removed.

The average amount pruned from all trees, regardless of variety and treatment, is 56 per cent. The average total growth removed from the Elberta trees was 58 per cent; from Stump trees 57 per cent and from the Carman trees 54 per cent.

Table 50 shows the per cent of total growth removed by treatments.

The largest average proportion removed, regardless of variety, was 74 per cent in the case of the "winter cut back" treatment. This treatment shows the greatest per cent removed in the case of Elberta and Carman, with 79 and 74 per cent, respectively. Stump had 67 per cent removed, which is slightly less than the per cent removed in the "summer and winter" treatment for this variety. The "summer and winter" treatment was second in

percentage removed, an average of 65 per cent having been pruned off all varieties. This treatment is first in the case of Stump with 68 per cent pruned off, but it is second with both Elberta (68 per cent pruned off) and Carman (60 per cent pruned off). The "winter not cut back" treatment was third in percentage removed and this percentage is very close to the general average for each and all varieties. The "summer-pruned" treatment was lowest in total amount removed and in percentage removed. Elberta was highest for the treatment with 34 per cent pruned off; Stump second, with 33 per cent, and Carman lowest with 27 per cent pruned off.

TABLE 50

RECORD OF PER CENT OF GROWTH REMOVED BY TREATMENT

1913

VARIETY	WNCB	WCB	S&W	S	ALL
	Per cent	Per cent	Per cent	Per cent	Per cent
Elberta,	56	79	68	34	58
Stump,	58	67	68	33	57
Carman,	57	74	60	27	54
All,	57	74	65	31	56

By referring to table 10 it will be seen that the summer pruning on Plots 3 and 6, receiving the "summer and winter" treatment, removed between one-third and one-half the total amount pruned. This is not as great a reduction in winter pruning as was found at Vineland.

EFFECT OF SUMMER PRUNING DURING 1913 ON TOTAL GROWTH AT NEW BRUNSWICK

The "summer only" treatment does not show indications of being checked by the practice of summer pruning. This treatment was second in total average of twig growth and in average per cent gain in twig growth. It was fourth in per cent increase in circumference.

TABLE 51. TABULATION OF PRUNINGS: AMOUNTS THINNED AND AMOUNTS CUT BACK, NEW BRUNSWICK, 1913–14

VARIETY	Tree No.	Row 3			Row 6			Row 5			Row 9		
		W & S			W & S			W C B			W C B		
		Thinned	Clipped	Total	Thinned	Clipped	Total	Thinned	Clipped	Total	Thinned	Clipped	Total
		Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
Elberta,	1	1792	197	1989	341	279	620	1718	185	1903	3102	179	3281
	2	1233	226	1459	1354	250	1604	1245	27	1272	1863	344	2207
	3	631	171	802	804	173	977	1534	105	1639	1968	48	2016
Average,	.....	1219	198	1413	833	234	1067	1499	106	1605	2311	190	2501
Stump,	4	1335	188	1523	1432	271	1703	1034	18	1052	1387	131	1518
	5	1122	246	1368	946	246	1192	1915	142	2057	3340	351	3691
Average,	.....	1229	217	1446	1189	259	1448	1475	80	1555	2364	241	2605
Carman,	6	640	260	900	1016	307	1323	2756	245	3001	1794	143	1937
	7	604	166	770	693	230	923	1638	221	1859	3250	201	3451
	8	1276	262	1538	580	250	830	1394	116	1510	1497	109	1606
Average,	.....	840	229	1069	763	262	1025	1929	194	2123	2180	151	2331
All Average,	.....	1079	215	1294	896	251	1147	1654	132	1787	2275	188	2463

AMOUNT OF TWIG GROWTH REMOVED IN CUTTING BACK AND THINNING AT NEW BRUNSWICK

Table 51 shows the amount of twig growth removed from each tree in the "winter and summer" and "winter cut back" treatments, separated into thinnings and clippings.

Table 52 summarizes these measurements. It will be noted that the difference in the amount of clipping for these two treatments is considerable, while with the "winter and summer" treatment an average of 19 per cent of the amount pruned in winter is clippings while the "winter cut back" treatment gives about 7 per cent.

TABLE 52

SUMMARY OF PRUNINGS: PER CENT THINNED AND CUT BACK NEW BRUNSWICK

VARIETY	Winter and Summer					Winter Cut Back				
	Total	Thinned		Clipped		Total	Thinned		Clipped	
	Inches	Inches	Per cent	Inches	Per cent	Inches	Inches	Per cent	Inches	Per cent
Elberta, ...	1242	1026	83	216	17	2053	1905	93	148	7
Stump, ...	1447	1209	84	238	16	2080	1919	92	161	8
Carman, ...	1047	802	76	236	24	2228	2055	92	173	8
All, ...	1220	987	81	233	19	2125	1965	93	160	7

In explanation of this, attention must be called to the fact that clipping in summer tends to increase the number of shoots, which would necessitate a greater amount of clipping at the dormant pruning, since an effort is made to cut back every prominent shoot. Where no thinning is done in summer, e. g., in the "winter cut back" treatment, a considerable amount of thinning is necessary in the winter pruning, which reduces the number of twigs to be cut back.

SUMMARY OF THE EFFECTS OF SUMMER PRUNING DURING 1913 UPON TOTAL GROWTH AT NEW BRUNSWICK

The evidence at New Brunswick supports that gained at Vineland to the effect that summer pruning in 1913 did not check the growth of the trees. The "summer only" treatment ranked second in average twig growth and second in per cent increase in twig growth. Its ranking as to average circumference is the

same as in 1912 (fourth); but the treatment ranks second in per cent increase in circumference. This statement is preliminary.

TIME REQUIRED FOR PRUNING AT NEW BRUNSWICK

The time of pruning was kept at New Brunswick as well as at Vineland. The system that required the greatest length of time was the "summer and winter" treatment. Trees receiving this treatment were given one pruning in June and the dormant season pruning in the late winter. The average time required to prune each tree was as follows:

	Summer	*Winter*	*Total*
Elberta, ...	1.15*	4.40	5.10
Stump, ...	1.53	3.57	5.50
Carman, ...	1.08	3.56	5.04

On the average, more wood was pruned in the "winter cut back" treatment, but the time required was somewhat less, as follows:

Elberta, ...	4.39
Stump, ...	5.08
Carman, ...	3.30

The "summer only" treatment required the following as the average pruning time per tree, where two prunings were made:

Elberta, ...	2.45
Stump, ...	4.00
Carman, ...	2.25

Where only the June pruning was performed, the average time was as follows:

Elberta, ...	1.20
Stump, ...	1.30
Carman, ...	1.05

The "winter not cut back" treatment required the shortest time to prune, with the following averages:

Elberta, ...	2.45
Stump, ...	2.46
Carman, ...	2.24

* The decimal point marks the division between minutes and seconds.

THE APPEARANCE OF THE TREES AT THE CLOSE OF THE SEASON OF 1913–14

Photographs were made at the close of the season of 1913–14 of the same trees that were discussed in the results of the season of 1912–13 (page 21).

Not Pruned

The "not pruned" trees (Stump, Row 19, Tree 2, and Carman, Row 20, Tree 4, at Vineland) are shown in figures 2 and 4, respectively. The Stump tree (fig. 2) has spread out considerably at the base and there is a noticeable thickening of the top, caused by the development of a large number of small twigs. The Carman tree (fig. 4) has also spread well at the base, and the top is more open. These two trees have reached about the same height, but the spread of the Carman is greater.

Winter Not Cut Back

A Carman tree, Row 17, Tree 2, at Vineland, is shown before pruning in figure 7 and after pruning in figure 8. This tree was pruned rather heavily at the end of the first season, a number of comparatively large branches being removed from the lower part of the trunk. This resulted in the formation of a number of suckers low on the trunk. These were pruned off and the other twigs and branches thinned out so that the tree appears to be more open.

The appearance of Elberta, Row 18, Tree 5, at Vineland, before and after pruning, is shown in figures 11 and 12. This tree was not very heavily pruned at the close of the first season, being compact and of good form. The character of the pruning at the close of the second season was merely to thin the twigs in the center. This tree has a more dwarfed, compact habit than any other so far shown, as it is apparently a foot lower than the others.

Stump, Row 16, Tree 3, at Vineland, received a heavy pruning at the close of the first season, so that before it was pruned in 1913–14 (fig. 15), a number of suckers had formed low on the trunk and on the scaffold branches. When these were removed

and the top thinned out, the tree appeared as illustrated in figure 16.

Winter Cut Back

Although Stump, Row 25, Tree 3, at Vineland, had a number of large twigs removed from the trunk, it did not, as might be expected, produce many suckers low upon the trunk, as shown in figure 19. Figure 20 is taken from a somewhat different position, but it shows the manner in which the tree was thinned out and cut back. Some of the prominent twigs simply had the tips removed, but the leaders were cut back to a side twig.

Carman, Row 14, Tree 5, at Vineland, produced a number of suckers on the scaffold branches during the second summer, as illustrated in figure 23. This tree was somewhat more dwarf than either the Stump or the Elberta in the same treatment, and after the thinning was done, the tips of the twigs were cut back very slightly, as illustrated in figure 24.

Winter and Summer

Stump, Row 10, Tree 4, at Vineland, was pruned once during the summer. Between the time of this pruning and the cessation of growth, the top was made very dense by a number of fine twigs, as shown in figure 29. These were thinned out considerably and the leading twigs cut back, when the tree had the appearance as shown in figure 30. This tree is a fair example of a tree pruned to the vase form.

Elberta, Row 12, Tree 4, at Vineland, illustrates again the rather compact and restricted growth of this variety in comparison with Carman and Stump. In height this tree is about two feet less than Stump and Carman trees in the same treatment. It did not make so many twigs in the top as the preceding tree, as shown in figure 35. After the tree had been thinned, only a few of the leading branches were cut back to a side twig, most of the others being merely clipped, as shown in figure 36.

Another Elberta tree of this treatment (Row 24, Tree 3, at Vineland) is shown before and after the winter pruning in figures 41 and 42. This is a tree that was allowed to form its head about 6 inches from the ground. It grew a little more vigorously

than the other Elberta tree in this treatment, but like that tree had comparatively little wood removed in pruning.

Summer Only

The winter aspect of the trees in the "summer only" treatment is shown in figure 49 for Carman, Row 8, Tree 4, at Vineland, and in figure 56, for Elberta, Row 4, Tree 3, at New Brunswick.

Figure 49 shows a tree that branches close to the ground. The top seems to be a little dense, and it undoubtedly has a few more twigs than would have been allowed to remain had the tree been pruned after the leaves had fallen.

The Elberta tree illustrated in figure 56 is rather more dwarf than any hitherto shown, but it is growing under different soil and climatic conditions. The top is apparently rather thick, due partly to the fact that all branches and twigs seem to be in the same plane, a fault not easily overcome in photographs.

SUMMARY

1—There is a great lack of accurate, scientific data on the pruning of the peach.

2—The objects of these experiments are to compare the effect of pruning (1) of different types upon the amount, form, and character of wood growth; (2) during the growing season in comparison with pruning done during the dormant season; (3) upon the strength, hardiness and length of life of the tree; (4) upon the position, quantity, size, color, quality, and time of maturity of the fruit; (5) upon the cost of spraying, thinning, and packing of fruit, removal of borers, and other details of orchard management.

3—Types of pruning studied are as follows:

Not pruned,
Winter-pruned, but not cut back,
Winter-pruned and cut back,
Winter- and summer-pruned,
Summer-pruned only.

The following varieties are used in the experiments:

Stump, Carman, Elberta.

4—The location of the experiments and the number of plots and trees are as follows:

Vineland: 2 plots to each treatment, 10 in all; 15 trees to each plot, 5 of each of the 3 varieties.

New Brunswick: 7 plots, 1 not pruned and 2 of each of the other treatments; 8 trees to each plot, 3 each of Elberta and Carman and 2 of Stump.

5—The soils are as follows:

At Vineland—sandy loam.

At New Brunswick—gravelly Penn (red shale) loam.

6—The period studied in this bulletin covers the first two seasons after the planting.

7—*Measurements of Total Linear Twig Growth During the First Season.* The general averages of the total linear twig growth during the first season follow:

	Vineland *Inches*	*New Brunswick* *Inches*
All varieties, ...	746	436
Stump, ...	800	609
Carman, ...	750	400
Elberta, ...	677	436

During the first season, the trees at Vineland averaged from about 200 to 350 inches more growth according to the variety than at New Brunswick. Stump made the best average total growth at both places. There was not much difference between Carman and Elberta. It is only fair to state that the Carman trees were somewhat the poorest at the time of planting.

After the growth measurements were computed at the close of the first season's growth, the various pruning treatments were assigned to certain plots. Table 53 shows the average size of the trees in these plots at the actual beginning of the pruning studies.

The following growth was made by the largest and the smallest trees:

	Stump		*Carman*		*Elberta*	
	Largest *Inches*	*Smallest* *Inches*	*Largest* *Inches*	*Smallest* *Inches*	*Largest* *Inches*	*Smallest* *Inches*
Vineland, ...	1392	273	1177	270	1509	321
New Brunswick, ..	1239	314	998	108	797	108

Table 53. Average Growth of Trees Grouped According to Future Treatments, 1912

Treatment	All				Stump				Carman				Elberta			
	Vineland		New Brunswick		Vineland		New Brunswick		Vineland		New Brunswick		Vineland		New Brunswick	
	Rank	Average Growth	Average Growth	Rank	Rank	Average Growth	Average Growth	Rank	Rank	Average Growth	Average Growth	Rank	Rank	Average Growth	Average Growth	Rank
		Inches	Inches			Inches	Inches			Inches	Inches			Inches	Inches	
NP.	4	697	496	1	5	650	558	3	3	771	322	4	4	653	570	1
WNCB,	5	633	480	2	4	790	541	4	5	690	452	2	5	562	472	2
WCB,	2	784	454	3	2	864	729	1	2	774	391	3	3	660	333	4
W & S,	1	790	418	5	3	845	702	2	4	722	306	5	1	806	342	3
S,	3	772	424	4	1	873	471	5	1	796	552	1	2	712	266	5

Table 54. Average Circumferences of Trees Grouped According to Future Treatments, 1912

Treatment	All				Stump				Carman				Elberta			
	Vineland		New Brunswick		Vineland		New Brunswick		Vineland		New Brunswick		Vineland		New Brunswick	
	Rank	Circumference	Circumference	Rank	Rank	Circumference	Circumference	Rank	Rank	Circumference	Circumference	Rank	Rank	Circumference	Circumference	Rank
		Inches	Inches			Inches	Inches			Inches	Inches			Inches	Inches	
NP,	1	4.15	3.90	1	3	4.17	3.93	1	1	4.33	4.14	1	5	3.00	3.12	3
WNCB,	4	3.91	3.44	2	2	4.27	3.69	3	5	3.65	3.29	2	1	3.84	3.54	1
WCB,	3	3.92	3.32	3	4	4.11	3.80	2	2	3.98	3.24	3	3	3.67	3.08	5
W & S,	2	4.01	3.03	5	1	4.33	3.09	5	3	3.89	2.78	5	3	3.67	3.26	2
S,	5	3.85	3.11	4	5	3.98	3.36	4	4	3.87	3.04	4	2	3.69	3.02	4

8—*Measurement of Circumference, First Season.* The circumferences of the trunks of the trees about six inches above the ground also were determined at the close of the first season, and the general averages follow:

	Vineland Inches	New Brunswick Inches
All varieties,	3.95	3.22
Stump,	4.17	3.54
Carman,	3.92	3.19
Elberta,	3.69	3.10

Only the Stump trees at Vineland averaged in excess of 4 inches in circumferences at the close of 1912.

The average circumferences of the trees as selected for the pruning treatments are given in table 54.

The range in circumference is given below:

	Stump		Carman		Elberta	
	Largest Inches	Smallest Inches	Largest Inches	Smallest Inches	Largest Inches	Smallest Inches
Vineland,	5.12	3.12	5.25	2.12	5.12	2.50
New Brunswick,	4.00	2.93	4.68	2.00	4.31	2.00

9—*Summer Pruning, 1913.* The summer-pruning treatments began during 1913 and the average amount of growth pruned off is recorded. In general about twice as much twig growth was removed at Vineland as at New Brunswick.

	Summer		Winter and Summer	
	Vineland Inches	New Brunswick Inches	Vineland Inches	New Brunswick Inches
Stump,	2092	1064	1184	702
Carman,	2067	781	1126	506
Elberta,	1741	1103	1158	500
All varieties,	1961	973	1156	552

Trees receiving the "summer only" treatment were pruned about the middle of June and in the early part of October. Those receiving the "winter and summer" treatment were pruned only once during the summer, about the middle of June.

TABLE 55. AVERAGE GROWTH ACCORDING TO TREATMENTS, 1913

TREATMENT	CARMAN				ELBERTA				ALL				STUMP			
	Vineland		New Brunswick		Vineland		New Brunswick		Vineland		New Brunswick		Vineland		New Brunswick	
	Rank	Growth	Growth	Rank	Rank	Growth	Growth	Rank	Rank	Growth	Growth	Rank	Rank	Growth	Growth	Rank
		Inches	Inches			Inches	Inches			Inches	Inches			Inches	Inches	
NP, ...	4	3795	4375	1	2	3913	2811	3	4	3892	3864	1	5	3980	4151	1
WNCB, ...	5	3265	2872	4	5	3034	3510	1	5	3522	3031	3	4	4259	2564	5
WCB, ...	2	4595	3056	2	4	3486	2670	4	2	4168	2919	4	1	4463	3089	4
W & S, ...	3	3835	2540	5	1	3971	2578	5	3	4047	2709	5	2	4316	3160	2
S, ...	1	4710	2949	3	3	3807	3257	2	1	4263	3117	2	3	4285	3160	2

TABLE 56. AVERAGE CIRCUMFERENCE ACCORDING TO TREATMENTS, 1913

TREATMENT	ALL				STUMP				CARMAN				ELBERTA			
	Vineland		New Brunswick		Vineland		New Brunswick		Vineland		New Brunswick		Vineland		New Brunswick	
	Rank	Circum-ference	Circum-ference	Rank	Rank	Circum-ference	Circum-ference	Rank	Rank	Circum-ference	Circum-ference	Rank	Rank	Circum-ference	Circum-ference	Rank
		Inches	Inches			Inches	Inches			Inches	Inches			Inches	Inches	
NP, ...	2	8.17	7.50	1	2	8.29	8.50	1	3	8.13	7.75	1	2	7.75	6.00	5
WNCB, ...	3	7.98	7.38	2	2	8.29	7.25	4	4	7.97	7.35	3	3	7.67	7.89	1
WCB, ...	1	8.42	7.36	3	1	8.31	7.38	3	1	9.00	7.54	2	1	8.03	7.17	3
W & S, ...	5	7.76	6.96	5	4	8.03	7.42	2	5	7.78	6.63	5	5	7.30	7.08	4
S, ...	4	7.89	6.98	4	5	7.82	7.00	5	2	8.21	6.79	4	4	7.58	7.20	2

10—*Measurement of Twig Growth of Second Season.* The amount of twig growth made during the second season also was recorded and the general averages follow:

	Vineland Inches	*New Brunswick Inches*
All varieties, ...	3981	3035
Stump, ...	4258	3155
Carman, ...	4026	3023
Elberta, ...	3608	2971

Stump again made the largest average total growth of the three varieties under test. The trees at Vineland also made an average of from 637 to 1103 inches more growth according to variety than those at New Brunswick. The average growth and rank by treatments follows in table 55.

The range in circumference at end of second season is shown below.

	Stump		*Carman*		*Elberta*	
	Largest Inches	*Smallest Inches*	*Largest Inches*	*Smallest Inches*	*Largest Inches*	*Smallest Inches*
Vineland, ...	9.75	7.00	10.25	5.50	9.25	6.50
New Brunswick, ..	8.50	6.25	8.75	5.75	9.25	6.00

11—*Per cent Gain in Twig Growth in 1913 Over That Made in 1912.* The per cent gain in twig growth in 1913 over that made in 1912 is given below:

	Vineland	*New Brunswick*
All varieties, ...	433	594
Stump, ...	432	417
Carman, ...	437	634
Elberta, ...	428	739

12—*A Comparison of Twig Growth Made by Trees of Varying Vigor.* The trees at Vineland made a larger average total growth, while those at New Brunswick made a higher average per cent gain over the growth made in 1912.

At Vineland, the trees that were below the average in 1912 made a greater per cent increase in 1913, but the actual average increase does not approach that made by the trees that were about the average in 1912.

At New Brunswick, a greater per cent increase in growth was recorded in favor of the trees that were below the average in 1912.

A comparison between trees on a basis of total growth indicates the size of the tree, but may not correctly indicate the rate of growth made by these trees in proportion to their vigor at the beginning.

Small trees at the end of the first season may not make as great a total twig growth as trees that were large, but, other things being equal, the per cent increase in growth will be greater for the small trees than for the large tree.

13—*Groups of Trees of Varying Vigor at End of First Season.* Considerable variation in total twig growth was found to occur between individual trees at the close of the first season. An attempt was made to determine how great a difference in linear twig growth had an influence upon the growth of the trees in the second season. Between some groups an average difference of 50 inches the first season was appreciable in the second season, while between others an average difference of 100 inches apparently had little or no influence.

The per cent gain in twig growth in 1913 is in inverse ratio to the amount of growth made in 1912.

14—*Measurement of Circumference at End of Second Season.* The general averages of the circumferences at the end of the second season follow:

	Vineland *Inches*	*New Brunswick* *Inches*
All varieties,	8.04	7.24
Stump,	8.14	7.33
Carman,	8.20	7.12
Elberta,	7.69	7.31

At the close of the second season none of the varieties at New Brunswick had attained an average trunk circumference of 7.50 inches, while at Vineland both Carman and Stump exceeded an average of 8 inches. The averages according to treatments are given in table 56.

15—*Per Cent Increase in Circumference Over 1912.* The general averages of the per cent increase in circumference over 1912 are given in the following:

	Vineland Per Cent	New Brunswick Per Cent
All varieties,	104	124
Stump,	96	104
Carman,	109	126
Elberta,	108	133

With one exception, all varieties made more than 100 per cent increase in trunk circumference in 1913 in comparison with that made in 1912.

The range in growth made by individual trees follows:

	Stump		*Carman*		*Elberta*	
	Greatest Inches	*Least Inches*	*Greatest Inches*	*Least Inches*	*Greatest Inches*	*Least Inches*
Vineland,	7108	2110	6883	1045	6746	1466
New Brunswick,	5020	1684	5355	1734	4425	1470

16—*Increase in Circumference of Trees of Varying Vigor.* In both the Vineland and the New Brunswick experiments, all the trees that were below the average in 1912 made a greater per cent increase in circumference than those that were above the average.

The smaller the circumference in 1912 the greater was the per cent increase in circumference in 1913.

17—*Total Inches of Twig Growth for Each One Inch Increase in Trunk Circumference.* It was also of interest to know the number of inches of twig growth made for each inch increase in trunk circumference in 1913. The average was 960 inches at Vineland and 738 inches at New Brunswick. The amount varied with the variety, as shown below:

	Vineland Inches	New Brunswick Inches
All varieties,	960	738
Stump,	1069	822
Carman,	931	744
Elberta,	853	699

The ratios upon the basis of the various pruning treatments is given in table 57.

Table 57. Growth Ratios According to Treatments

TREATMENT	ALL				STUMP				CARMAN				ELBERTA			
	Vineland		New Brunswick		Vineland		New Brunswick		Vineland		New Brunswick		Vineland		New Brunswick	
	Rank	Ratio	Ratio	Rank	Rank	Ratio	Ratio	Rank	Rank	Ratio	Ratio	Rank	Rank	Ratio	Ratio	Rank
NP, ...	3	971	1016	1	5	970	...	..	3	971	1099	1	..	...	828	1
WNCB, ...	5	822	712	4	4	1020	809	3	5	756	709	4	4	710	693	3
WCB, ...	4	924	722	3	3	1061	854	2	4	916	710	3	3	799	653	5
W & S, ...	1	1088	669	5	1	1200	680	4	2	986	660	5	1	1079	674	4
S, ...	2	1016	804	2	2	1114	867	1	1	1058	786	2	2	852	776	2

Table 58. Amounts in Pruning, According to Treatments

TREATMENT	ALL				STUMP				CARMAN				ELBERTA			
	Vineland		New Brunswick		Vineland		New Brunswick		Vineland		New Brunswick		Vineland		New Brunswick	
	Per cent	Inches	Inches	Per cent	Per cent	Inches	Inches	Per cent	Per cent	Inches	Inches	Per cent	Per cent	Inches	Inches	Per cent
WNCB, ...	47	1662	1760	57	49	2085	1492	58	44	1450	1626	57	49	1482	2028	56
WCB, ...	69	2891	2152	74	72	3242	2083	67	66	3071	2249	74	69	2384	2100	79
W & S, ...	61	2452	1767	65	64	2768	2148	68	55	2111	1536	60	63	2484	1744	68
S, ...	46	1959	973	31	49	2086	1064	33	44	2067	781	27	46	1741	1103	34

The range in ratios in the various varieties at Vineland follow:

Stump,	528 to 1527
Carman,	484 to 1861
Elberta,	397 to 1750

The trees that made the largest growth generally showed the widest ratio. A few trees made a large growth and a relatively small ratio; and a few others had a relatively small growth and a relatively large ratio of increase.

The evidence here shown points to the probability that branches low down on the trunk and permitting shoots or suckers to develop and remain on the lower part of the trunk during the growing season, tend to increase the girth of the trunk more rapidly than where such shoots are removed and where the trunk is longer and the branches higher above the ground.

In the summer-pruned treatments the shoots are removed from the trunk, giving in almost every case a greater twig growth to each inch increase in trunk circumference, while on the other hand, in the "not pruned" and "winter-pruned" treatments, the twigs were allowed to remain on the trunks, resulting in a narrower ratio of increase in trunk circumference to increase in twig growth.

It is also apparent in these experiments that if most of the growth is made at the very top of the tree, it will have less proportionate influence upon the circumference of the trunk near the ground. In other words, the increase in trunk circumference is determined not only by the total amount of growth, but by the location of that growth with respect to the trunk.

18—*Dormant Season Pruning at Close of Second Season.* The amount of twig growth removed in the dormant season pruning at the close of the second season's growth was measured, and the general averages follow:

	Vineland		*New Brunswick*	
	Inches	*Per Cent*	*Inches*	*Per Cent*
All varieties,	2245	56	1661	56
Stump,	2576	59	1710	57
Carman,	2146	53	1548	54
Elberta,	2009	56	1744	58

Table 58 shows the amounts removed according to treatments.

The average amount of wood growth pruned off at Vineland varied from 1662 inches, or 47 per cent, in the "winter not cut back" treatment to 2891 inches, or 69 per cent, in the "winter cut back" treatment. The amount pruned off at New Brunswick

varied from 973 inches, or 31 per cent, in the "summer only" treatment to 2152 inches, or 74 per cent, in the "winter cut back" treatment. The amounts pruned off also vary according to the variety.

The amounts pruned off in the "winter cut back" treatment are between two-thirds and three-fourths of the total twig growth.

19—*Effect of Summer Pruning on Amount of Winter Pruning Necessitated.* The amount of twig growth pruned off was separated into the amount removed in thinning out twigs and the amount removed in clipping back the tips of twigs. The percentages of each follow based on the total removed.

	Vineland		*New Brunswick*	
	Per Cent Thinned	*Per Cent Clipped*	*Per Cent Thinned*	*Per Cent Clipped*
Winter Cut Back, ...	92	8	93	7
Winter and Summer, ...	85	15	81	19

From the above it will be noted that summer pruning reduced the amount of the necessary thinning of twig growth in winter, but increased the amount of clipping back due to the increase in the vigor of the secondary twigs on the leaders.

The summer pruning of the "winter and summer" treatment reduced the pruning required in winter by about one-half at Vineland, and by one-third to one-half at New Brunswick, as compared with the "winter cut back" treatment.

Pinching back the main twigs increased the number of vigorous secondary or side twigs.

20—*Time Required to Prune.* A record was kept of the time required to prune each tree. It is probably somewhat greater than would be the case under commercial conditions, since care was taken to collect the twigs pruned off and to follow the pruning treatments in a detailed manner. More time was required also in pruning the trees that were photographed than was the case with the other individuals.

The average time required to prune the trees in terms of minutes and seconds follows:

	Stump		*Carman*		*Elberta*	
	Vineland	*New Brunswick*	*Vineland*	*New Brunswick*	*Vineland*	*New Brunswick*
WNCB, ...	3.23	2.46	2.15	2.24	2.34	2.45
WCB, ...	4.49	5.08	4.30	3.30	3.15	4.39
W & S, ...	5.30	5.50	4.35	5.04	5.25	5.10
S, ...	5.30	4.00	6.06	2.25	3.30	2.45

The "winter cut back" treatment required an average of from one to two minutes more per tree than the "winter not cut back." The pruning in summer is made difficult by the presence of the foliage and fruit. It will be noted that the time required for the "summer only" treatment was less in some cases than the "winter and summer." This is probably because the late summer pruning in September was not quite as severe and thorough as the winter pruning on the "winter and summer" treatment.

The average cost of the pruning of the various treatments in 1913 figured on the basis of 100 trees, and labor at 20 cents per hour, is given in table 60.

TABLE 60

AVERAGE COST OF PRUNING 100 TREES AT 20 CENTS PER HOUR.

TREATMENT	STUMP		CARMAN		ELBERTA		
	Vineland	New Brunswick	Vineland	New Brunswick	Vineland	New Brunswick	Average
WNCB,	$1.13	$0.92	$0.75	$0.80	$0.86	$0.92	$0.90
WCB,	1.61	1.71	1.50	1.17	1.08	1.55	1.44
W & S,	1.83	1.94	1.54	1.89	1.81	1.72	1.79
S,	1.83	1.33	2.03	0.81	1.17	0.92	1.35

Stump was the most expensive variety of the three to prune both at Vineland and New Brunswick, and Elberta was more expensive to prune at New Brunswick than Carman.

Of the various treatments the "winter not cut back" was the cheapest to prune and the "winter and summer" the most expensive.

Summer pruning apparently did not check or reduce the amount of twig growth made by the trees during the second season.

The "summer only" treatment at Vineland made the greatest average total growth and the "winter cut back" treatment was second.

At New Brunswick the "not pruned" treatment made the best total growth and the "summer only" was second.

It is too early in these experiments to draw any definite conclusions as to the actual effect of the various pruning treatments, but these data are submitted to furnish the details of the study, and to show the actual behavior of the trees.

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AGRICULTURAL

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BULLETIN 327

New Brunswick, N. J.

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LOUISA VANUXEM, Home Demonstration Agent for Newark.
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CONTENTS

NEW JERSEY

AGRICULTURAL EXPERIMENT STATIONS

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COMMERCIAL FEEDING STUFFS AND REGISTRATIONS FOR 1918

By

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The law entitled "An Act Concerning Commercial Feeding Stuffs" requires an annual inspection of the materials on sale in this state and the publication of the results obtained. In accordance with these requirements the inspection was made and the results obtained are herewith presented.

The Requirements of the Law

The object of the law may be stated in one word—protection, and it applies with equal force to the consumer and to the honest manufacturer. In order to accomplish this desired result, the following requirements are given:

1. A statement attached to the material which will certify the name and address of the party responsible for placing the commodity on the market; the minimum content of protein, the minimum content of fat, the maximum content of crude fiber, and the specific name of each ingredient contained in the feed.

2. The registration annually of the information to be attached to the feed.

3. The inspection of the materials as sold and the publication of the results of the inspection.

It is apparent that all of the above requirements are necessary, but the most important to the consumer is the one relating to the statements required to be attached to the materials as sold. These statements should be closely studied, since the value of a feed for any particular purpose not only depends upon its content of protein,

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[1]The chemical analyses were made by Ralph L. Willis, Claude S. Clarkson and Archie C. Wark.

fat and fiber, but also upon the materials from which these nutrients are derived. It must be remembered, however, that because a material is properly branded it is not necessarily an economical feed, since the law does not prohibit the use of any material that is not injurious, nor does it regulate the proportionate amounts of the various ingredients used.

Registrations

The law requires an annual registration of the feeding stuffs that will be offered for sale, and in accordance with this requirement 469 manufacturers and jobbers registered 2553 brands.

During the regular inspection, 39 brands were located which had not been registered, and the parties having the materials were notified of the requirement necessary to be attended to before sales could be legally made. Registrations were received for most of these brands within a short time. This condition was an improvement over that reported for the preceding inspection, and it is evident that, as a rule, the manufacturers are attending to this question at the proper time. The chief offenders are the local manufacturers, but whether it is from a lack of knowledge as to the requirement or for any other reason, it is a question that should be carefully considered, so that the registrations may be made at the proper time.

On account of the present conditions of the trade, several requests have been received to re-register brands with a lower guarantee than had been previously registered. In many cases these requests have been caused by a federal regulation regarding the use of certain materials, or on account of the scarcity of certain materials that had been previously used in the formula. We appreciate the condition and we will cooperate in every manner possible, but since the law distinctly states "a brand name once registered shall not be changed to a lower grade at any subsequent registration," we have no authority to accept a registration if it is a lowering of the standard. When such changes are necessary the brand name can be changed in some way or a new brand name can be given. The adoption of either of these methods will fulfill the object of the manufacturer and will also meet the requirements of the state law.

Tonnage of Feeding Stuffs Sold

Manufacturers and those responsible for feeding stuffs sold in this state are required to render, on July 1 and January 1 of each year, reports showing the total tonnage sold during the six months preceding these dates. Table 1 is a summary of the reports received during the past five years.

TABLE 1
SUMMARY OF TONNAGE REPORTS

Year	July Reports	January Reports	Total for the Year
1913	93,664.17	102,560.00	196,224.17
1914	88,192.50	114,508.73	202,701.23
1915	103,626.91	124,563.34	228,190.25
1916	111,910.84	123,437.16	235,348.00
1917	114,939.37	119,101.06	234,040.43

Reports have been issued by other departments which show a large decrease in the livestock in this state, but according to the figures tabulated, the sales for the year 1917 were nearly 99.5 per cent of those reported for 1916 and about 102.5 per cent of those reported for 1915. It is difficult to account for the tonnage sold unless a system of heavier feeding was practiced or home-grown feeding stuffs were replaced to a greater extent by commercial feeds.

INSPECTION

The inspection during the past year was conducted in the same general manner as during previous years, but many conditions developed which made it the most complicated one in the experience of these inspections. The quantity of feeding stuffs in stock at any place was comparatively small, and in many instances there was no stock. Consequently, when a shipment was received it was quickly delivered to the various customers. This condition caused the inspector additional work in order to secure the samples. By close application to the work, we feel not only that representative samples were secured but that all of the different brands sold in an appreciable quantity were represented in the collection.

In addition to the difficulty stated, just before the inspection was started one of the inspectors resigned, and as it was impossible to fill the position immediately, the itinerary had to be arranged so that the territory could be covered by one man. In accordance with this arrangement the samples were collected by Mr. W. A. Cray.

During the inspection 1059 samples were officially collected, and 45 samples were received from individuals. Every county in the state was visited and the samples were received from 297 dealers and consumers, whose addresses include the names of 160 towns and cities.

EXAMINATION

Every sample reported was examined by the use of the official methods adopted by the Association of Official Agricultural Chemists in order to determine the content of protein, fat and fiber. The

microscopical examinations were not made this year because the member of the staff who had the required experience in this kind of work was called for service in the army. The results of these examinations and the ingredients guaranteed are to be found on the following pages.

RESULTS OF THE INSPECTION

The total number of samples examined was 977, and of this number 932 samples were collected by our official inspector in the manner as prescribed in the law. The 45 samples submitted by individuals were reported directly to those requesting the analyses, and the results are not published in this report. From the examination of the official samples it was found that 260, or 27.9 per cent, did not substantially satisfy the guarantees given for the content of protein, fat and fiber. The deficiencies found consisted of the following: protein, 87; fat, 83; and fiber, 151; 207 samples being deficient in one nutrient, 45 deficient in two nutrients, and 8 deficient in the three nutrients. The above figures show that, taken as a whole, there was an improvement in the character of the feeds sold during the past year when compared with the results reported for the preceding inspection. This is encouraging, but there is still a large percentage of deficiencies to be eliminated before the condition can be considered entirely satisfactory. Table 2 gives a comparison of the deficiencies found in the last five inspections.

TABLE 2
STATEMENT OF DEFICIENCIES

Inspection	Samples Examined	Per Cent of Samples Deficient	Per Cent of Samples Deficient in—		
			Protein	Fat	Fiber
1914	740	17.7	8.2	5.4	7.2
1915	920	17.2	6.7	6.8	6.6
1916	1102	26.6	9.3	9.3	14.0
1917	1103	32.3	10.0	9.3	19.6
1918	932	27.9	9.3	8.9	16.2

A study of the question as to the composition of the animal products, such as digester tankage and meat scrap or meat meal, was made by the Association of Feed Control Officials of the United States, and as a result of this study it was agreed that if these products contained more than 10 per cent of phosphoric acid, the brand name of the material must contain information showing that bone is present in a larger proportion than is usually found in these products when true to their name. In order to ascertain this in-

formation, each sample of the animal products was examined for its content of phosphoric acid and the results are tabulated. Six samples were not properly branded, since they contained an excess of bone which was not indicated by the brand name.

THE SELECTION OF FEEDING STUFFS

The value of a feeding stuff depends upon the amount of its nutrients which an animal can, under normal conditions, digest and assimilate for the purpose of building up the growth, repairing the natural waste of the body and producing energy.

Feeds, generally speaking, contain more or less of indigestible matter which does not contribute to the support of the body, and on account of this condition the purchase of a feed that will give the maximum results requires considerable skill on the part of the stock feeder.

Concentrated feeding stuffs are generally purchased for the purpose of supplementing the materials raised on the farm, and as such materials usually contain low percentages of protein and fat, the selection of a material should be governed by its content of these nutrients. In all classes of feed, high percentages of protein and fat indicate a high feeding value, while a high percentage of fiber indicates a low feeding value. In such feeds the amount of protein should determine the price to be paid, other things being equal, and if a selection is to be made between two feeds having the same amount of protein and fat, the one containing the smaller amount of fiber is to be preferred.

If a mixed feed is to be selected, valuable information could be obtained by comparing the analyses of a number of feeds, including the ingredients used in preparing the mixtures. Not much dependence can be placed upon the price of a feed as a guide to its feeding value, since the selling price does not, as a rule, bear any relation to the content of the nutrients present. In accordance with this it is quite evident that the only safe rule to follow is to compare the feeds and their selling prices.

The question of the cost of feeding stuffs has always been one that needed attention, and if this was true for the past years it is certainly true in these times of abnormal prices. Under the present conditions attention to the cost of a material is one of the most important to the consumer, since it may mean either the success or failure of the desired object of purchasing the material. Those who have been purchasing feeding stuffs need not be reminded of the increase in the cost of these materials during the past two years, but it may emphasize the statements made above in regard to this

question if the averages of some figures which were collected by our inspectors during the past three years are tabulated. Table 3 gives the average retail selling prices of some of the more important feeding stuffs as they have been obtained and reported during the past three years.

TABLE 3
A COMPARISON OF THE AVERAGE RETAIL SELLING PRICES

	Average Per Ton During the Inspection of		
	1916	1917	1918
Alfalfa Meal	$31.78	$32.50	$47.00
Brewers' Dried Grains	29.25	29.41	52.80
Buckwheat Feed	25.93	39.00	54.00
Buckwheat Middlings	29.00	34.00	51.22
Cocoanut Meal	28.00	33.00	48.00
Corn Bran	27.40	30.10	44.00
Corn Feed Meal	33.22	40.33	81.10
Corn Gluten Feed	30.11	36.30	59.28
Cottonseed Meal	37.75	46.91	59.00
Distillers' Dried Grains (Corn)	34.50	36.00	63.75
Dried Beet Pulp	27.25	37.00	49.25
Hominy Feed	31.73	40.40	65.43
Linseed Oil Meal	43.38	44.12	60.07
Malt Sprouts	28.17	32.00	44.50
Meat Meal	57.30	58.00	96.40
Peanut Oil Meal	34.50	35.00	59.00
Rye Bran	26.33	29.57	42.80
Rye Feed	32.00	33.00	43.00
Rye Middlings	30.94	35.31	50.68
Wheat Bran	28.16	32.30	45.37
Wheat Feed	28.58	35.00	46.60
Wheat Feeding Flour	37.73	41.30	68.00
Wheat Middlings	33.11	38.47	57.12

Table 4 is a summary of the inspection and gives the average composition of the various materials examined, with the exception of Calf Meals, Feed Mixtures and Poultry Foods. The reason the averages are not given for these three classes of feeds is on account of the variability of the different brands which are reported under their respective headings. In addition to the average composition, the average selling prices and the deficiencies are noted.

In preparing this tabulation the Protein as found is considered to satisfy its guarantee if it is not more than 1 per cent below it. An allowance of 0.5 per cent is also made for the Fat and the Fiber determinations.

Table 4

SUMMARY OF THE RESULTS OF THE INSPECTION

Feeding Stuff	Number of Samples Examined	Average Composition: Moisture	Protein	Fat	Fiber	Average Retail Selling Price per Ton	Number of Samples Satisfied Guarantees	No. of Samples Deficient in—: Protein	Fat	Fiber	One Nutrient	Two Nutrients	Three Nutrients
		%	%	%	%	$							
Alfalfa Meal	12	8.05	15.30	1.60	28.20	47.00	10	1	2	1	1	..	1
Brewers' Dried Grains	17	7.70	24.83	6.49	14.58	52.80	9	5	2	6	3	5	..
Buckwheat Feed	2	12.96	21.88	5.39	2.89	54.00	1	1	1	..	..	1	..
Buckwheat Middlings	14	13.00	30.64	7.77	4.36	51.22	7	4	2	2	6	1	..
Buckwheat Offal	7	11.03	19.30	5.01	16.10	38.30	4	1	..	3	2	1	..
Calf Meal	8	.....	.....	.....	.....	89.71	3	3	1	4	2	3	..
Cocoanut Meal	3	10.59	20.00	8.14	9.58	48.00	1	2	..	..	2	..	..
Copra Cake Meal	2	7.40	20.50	8.61	9.65	50.00	2	..	..	..	..	..	..
Cottonseed Feed	9	7.67	24.12	4.57	20.35	44.60	6	3	1	1	2	..	1
Cottonseed Meal	18	7.58	37.88	6.65	10.54	59.00	12	5	1	..	6	..	..
Corn Bran	2	10.20	9.38	5.99	10.06	44.00	2	..	..	..	..	..	..
Corn Feed Meal	8	11.81	9.12	4.76	2.01	81.10	6	..	..	2	2	..	..
Corn Gluten Feed	18	8.58	25.53	2.09	6.85	59.28	16	1	1	..	2	..	..
Corn Gluten Meal	1	8.56	39.69	0.99	1.18	68.00	1	..	..	..	..	..	..
Corn and Cob Meal	14	11.81	7.40	3.51	5.30	56.20	13	..	..	1	1	..	..
Corn and Oats	22	11.25	10.57	4.42	3.47	73.55	19	..	..	3	3	..	..
Distillers' Dried Grains—Corn	4	7.03	30.92	9.11	11.39	63.75	2	..	1	1	2	..	..
Distillers' Dried Grains—Rye	1	5.97	18.44	6.98	18.33	.....	1	..	..	..	..	..	..
Distillers' Dried Grains—Yeast	4	6.95	20.66	6.73	17.12	48.50	1	1	3	..	2	1	..
Dried Beet Pulp	5	8.31	9.11	0.66	19.54	49.25	5	..	..	..	..	..	..
Feed Mixtures	275	.....	.....	.....	.....	56.00	194	15	18	64	66	14	1
Fish Scrap	2	6.07	45.41	2.13	[1] ..	*4.63	....	1	1	..	2	..	..
Hominy Feed	14	8.98	11.26	7.56	4.19	65.43	12	..	1	1	2	..	..
Laxo Cake Meal	1	9.97	26.56	7.01	9.86	.....	1	..	..	..	..	..	..
Linseed Oil Meal	13	9.39	32.76	6.84	7.88	60.07	10	3	..	..	3	..	..
Malt Sprouts	3	7.88	24.33	1.33	12.54	44.50	2	1	..	1	..	1	..
Meat Meals	20	6.99	46.58	14.31	[2] ..	*4.82	11	9	..	..	9	..	..
Oat Feed (largely oat hulls)	3	6.93	3.03	1.18	30.41	31.50	....	3	3	2	..	1	2
Oat Hulls, reground	1	7.26	7.25	2.05	25.06	.....	....	..	1	..	1	..	..
Peanut Oil Meal	1	7.40	29.81	12.12	9.11	59.00	....	..	..	1	1	..	..
Poultry Bone	1	6.44	21.88	4.99	[3] ..	*3.95	....	1	..	..	1	..	..
Poultry Foods	239	.....	.....	.....	.....	79.93	190	22	20	23	36	10	3
Rye Bran	14	11.96	15.53	2.53	4.45	42.80	8	..	1	5	6	..	..
Rye Feed	1	12.32	14.44	2.34	2.83	43.00	1	..	..	..	..	..	..
Rye Middlings	20	12.24	14.04	2.60	3.17	50.68	14	..	1	5	6	..	..
Tankage, digester	1	6.52	56.75	8.92	[4] ..	*5.18	....	1	..	..	1	..	..
Wheat Bran	68	10.01	15.11	4.29	9.42	45.37	45	2	15	12	17	6	..
Wheat Feeding Flour	6	9.69	17.30	4.98	3.26	68.00	5	..	..	1	1	..	..
Wheat Feed	6	8.95	16.19	4.55	7.61	46.60	6	..	..	..	..	..	..
Wheat Middlings	69	10.69	16.35	4.77	5.16	57.12	49	2	7	12	19	1	..
Wheat and Rye Middlings	2	10.60	17.26	4.67	6.23	56.25	2	..	..	..	..	..	..
Wheat Middlings and Maizo Red Dog Flour	1	7.30	13.50	7.72	3.63	64.00	1	..	..	..	..	..	..

[1] Phosphoric acid 17.51%
[2] Phosphoric acid 9.92%
[3] Phosphoric acid 23.62%
[4] Phosphoric acid 7.57%

* Average selling price per cwt.

COTTONSEED MEAL

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
	M. F. Baringer, Philadelphia, Pa.								
18885	Goodlow Cottonseed Meal	Burlington	6.24	41.50	36.00	8.44	5.00	8.57	16.00
18956	Goodlow Cottonseed Meal	Mt. Holly	5.93	39.88	36.00	6.90	5.00	9.90	16.00
	F. W. Brode & Co., Memphis, Tenn.								
18280	Dove Brand Cottonseed Meal	Dover	7.15	37.31	38.62	7.44	6.00	9.66	12.00
18766	Dove Brand Cottonseed Meal	Plainfield	8.06	35.13	38.62	7.30	6.00	11.40	12.00
18281	Owl Brand Cottonseed Meal	Dover	7.14	40.99	41.00	6.46	6.00	9.71	10.00
18717	Owl Brand Cottonseed Meal	Newark	7.30	42.56	41.00	6.76	6.00	8.41	10.00
	Buckeye Cotton Oil Co., Cincinnati, O.								
18502	Buckeye Good Cottonseed Meal	Flemington	7.82	36.63	36.00	6.05	5.00	12.49	14.00
	S. P. Davis, Little Rock, Ark.								
18049	Goodluck Brand Cottonseed Meal	Camden	7.67	42.00	41.00	6.59	6.00	6.47	9 00
18552	Beauty Brand Cottonseed Meal	Pennington	7.32	35.94	36.00	6.84	6.00	12.65	12.00
180021	Beauty Brand Cottonseed Meal	Vineland	8.73	34.94	36.00	7.63	6.00	10.08	14.00
	Empire Grain & Elevator Co., Binghamton, N. Y.								
18251	Cottonseed Meal	Andover	8.01	36.81	38.50	7.17	6.00	11.19	12.00
	J. M. Macdonald, Cincinnati, O.								
18235	Kineda Prime Cottonseed Meal	Morristown	8.08	39.06	38.60	6.35	6.00	9.84	12.00
	W. C. Nothern, Little Rock, Ark.								
18224	Butterfly Brand Cottonseed Meal	Morristown	8.68	37.88	38.62	6.20	6.00	10.30	12.00
	Geo. B. Robinson, Jr., New York City.								
18817	Cottonseed Meal	Jamesburg	7.04	35.50	36.00	6.76	6.00	11.13	15.00
	J. E. Soper Co., Boston, Mass.								
18826	Puritan Cottonseed Meal	Long Branch	9.07	35.69	36.00	3.57	5.00	14.48	15.00
	Union Seed & Fertilizer Co., N. Y. City.								
18185	American Red Tag Cottonseed Meal	Ridgewood	7.76	38.31	38.62	6.03	6.00	10.91	11.50
18294	Surety Brand Cottonseed Meal	Branchville	7.01	34.19	36.00	6.13	5.50	12.11	14.00
18740	Surety Brand Cottonseed Meal	Jersey City	7.41	37.50	36.00	7.09	5.50	10.42	14.00
	Average	....	7.58	37.88	.....	6.65	.....	10.54	.....

COTTONSEED FEED

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
	M. F. Baringer, Philadelphia, Pa.								
18257	M. F. B. Cottonseed Feed	Newton	9.26	17.56	20.00	3.84	3.00	22.89	26.00
18952	M. F. B. Cottonseed Feed	Mt. Holly	8.24	19.81	20.00	4.10	3.00	23.28	26.00
	F. W. Brode & Co., Memphis, Tenn.								
18873	Jay Brand Cottonseed Feed	Columbus	8.44	37.00	36.00	6.34	5.00	11.52	14.00
	Buckeye Cotton Oil Co., Cincinnati, O.								
18307	Buco Cottonseed Feed	Sussex	6.53	22.13	20.00	4.02	3.50	22.14	27.00
	C. L. Montgomery & Co., Memphis, Tenn.								
18915	Star Brand Cottonseed Feed	Mt. Holly	5.07	34.56	36.00	5.18	6.00	16.37	14.00
	Union Seed & Fertilizer Co., N. Y. City.								
18309	Columbia Cottonseed Feed	Sussex	7.91	25.25	20.56	5.20	3.00	16.95	25.00
18916	Columbia Cottonseed Feed	Mt. Holly	6.68	20.31	20.56	4.27	3.00	24.18	25.00
	S. C. Woolman & Co., Philadelphia, Pa.								
18479	Globe Brand Cottonseed Feed	Lambertville	8.67	18.75	20.00	3.90	3.50	23.04	27.00
18874	Creamo Brand Cottonseed Feed	Columbus	8.19	21.69	20.00	4.24	4.00	22.74	25.00
	Average	....	7.67	24.12	.....	4.57	.....	20.35	.....

LINSEED MEAL

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein		Fat		Fiber	
				Found	Guaranteed	Found	Guaranteed	Found	Guaranteed
	American Linseed Co., New York City.								
18039	Old Process Oil Meal	Camden	8.38	36.13	34.00	5.56	5.00	7.11	8.00
18283	Old Process Oil Meal	Dover	8.84	33.25	34.00	5.84	5.00	8.25	8.00
	American Milling Co., Peoria, Ill.								
18006	Old Process Oil Meal	Plainsboro	9.31	34.19	34.00	6.20	5.00	7.73	8.00
18151	Amco Old Process Linseed Meal and O. P. Screenings Oil Feed	Paterson	9.99	29.06	30.00	7.22	5.00	9.12	10.00
18646	Amco Old Process Linseed Meal and O. P. Screenings Oil Feed	Newark	8.74	29.31	30.00	6.55	5.00	9.28	10.00
	Archer-Daniels Linseed Co., Minneapolis, Minn.								
18238	Old Process Ground Oil Cake	Morristown ...	10.62	32.69	33.00	6.80	6.00	7.32	10.00
	Spencer Kellogg & Son, Inc., Buffalo, N. Y.								
18147	Pure Old Process Oil Meal	Passaic	10.06	31.56	33.00	6.11	5.00	7.98	10.00
18653	Pure Old Process Oil Meal	Newark	8.03	35.81	33.00	6.19	5.00	7.52	10.00
	Mann Bros. Co., Buffalo, N. Y.								
18345	Pure Old Process Oil Meal	Bernardsville ..	9.86	32.50	34.00	8.10	6.00	7.43	10.00
18610	Pure Old Process Oil Meal	Newark	9.77	31.50	34.00	7.61	6.00	7.29	10.00
	Midland Linseed Products Co., Minneapolis, Minn.								
18288	Pure Old Process Ground Linseed Cake	Branchville	9.78	33.19	32.00	7.47	5.00	7.28	9.50
18689	Pure Old Process Ground Linseed Cake	Caldwell	10.11	33.31	29.00	7.64	5.00	8.16	9.50
	Sherwin-Williams Co., Cleveland, O.								
18530	S. W. C. Linseed Oil Meal	Pennington	8.55	33.38	33.00	7.61	6.00	7.94	8.00
	Average	....	9.39	32.76	.....	6.84	.....	7.88	.....

LAXO CAKE MEAL

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
	Chicago Heights Oil Mfg. Co., Chicago, Ill.								
18614	Old Process Laxo Cake Meal	Newark	9.97	26.56	25.00	7.01	6.00	9.86	12.00

CORN GLUTEN FEED

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
	American Maize Products Co., N. Y. City.								
18018	Cream of Corn Gluten Feed	Camden	8.29	22.75	23.00	2.08	1.50	6.32	8.50
18786	Cream of Corn Gluten Feed	Townley	8.22	24.88	23.00	1.46	1.50	5.94	8.00
	Corn Products Refining Co., N. Y. City.								
18041	Buffalo Corn Gluten Feed	Camden	8.54	30.31	23.00	1.39	1.00	5.79	8.50
18655	Buffalo Corn Gluten Feed	Newark	9.96	27.13	23.00	2.22	1.00	5.85	8.50
18200	Buffalo Corn Gluten Feed	Boonton	7.33	24.94	23.00	4.12	1.00	7.93	8.50
18329	Globe Corn Gluten Feed	Hamburg	9.77	26.75	23.00	1.17	1.00	7.20	8.50
18788	Globe Corn Gluten Feed	Townley	7.66	24.19	23.00	2.90	1.00	8.73	8.50
	Douglas Co., Cedar Rapids, Iowa.								
18514	Douglas Corn Gluten Feed	Titusville	10.71	25.44	23.00	1.90	1.00	6.81	8.00
18806	Douglas Corn Gluten Feed	Elizabeth	8.64	23.90	23.00	1.84	1.00	7.14	8.00
	Grain Products Sales Co., New York City.								
18312	Union Gluten Feed	Lafayette	9.33	23.25	23.00	2.69	1.00	6.15	8.50

CORN GLUTEN FEED—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
	Nowak Milling Corporation, Buffalo, N. Y.								
18168	Corn Gluten Feed	Paterson	8.56	29.06	23.00	1.20	1.00	6.56	8.50
	Phelps & Sibley Co., Cuba, N. Y.								
18076	Corn Gluten Feed	Hackensack	9.75	26.31	23.00	1.09	1.00	7.18	8.50
	Piel Bros. Starch Co., Indianapolis, Ind.								
18372	P. Bros. Corn Gluten Feed	Hackettstown	7.22	25.38	23.00	1.71	2.00	6.90	8.00
18674	P. Bros. Corn Gluten Feed	Newark	8.63	26.06	23.00	1.67	2.00	6.73	8.00
	Rosekrans-Snyder Co., Philadelphia, Pa.								
18753	Jenks Corn Gluten Feed	Somerville	8.33	25.04	22.00	2.09	3.00	6.87	8.00
	A. E. Staley Mfg. Co., Decatur, Ill.								
18400	Staley's Corn Gluten Feed	Vail	6.66	26.56	23.00	2.27	2.50	6.54	12.00
	Union Starch & Refining Co., Edinburg, Ind.								
18553	Union Corn Gluten Feed	Pennington	8.10	21.75	23.00	2.85	3.00	7.73	8.00
	C. W. Wager & Co., Philadelphia, Pa.								
18487	Clinton Corn Gluten Feed	Lambertville	8.69	25.88	23.00	2.95	3.00	6.84	8.00
	Average	....	8.58	25.53	.....	2.09	.....	6.85	.....

CORN GLUTEN MEAL

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
	Corn Products Refining Co., New York City.								
18284	Diamond Corn Gluten Meal	Dover	8.56	39.69	40.00	0.99	1.00	1.18	4.00

HOMINY FEED

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
	American Hominy Co., Indianapolis, Ind.								
18001	Homco Hominy Feed	Plainsboro	8.42	10.88	10.00	9.20	6.00	5.20	7.00
18220	Homco Hominy Feed	Mountain View.	6.56	11.06	10.00	9.03	6.00	5.12	7.00
	M. F. Baringer, Philadelphia, Pa.								
18256	Hominy Feed	Newton	10.27	11.75	9.00	6.75	6.00	2.55	10.00
	Buffalo Cereal Co., Buffalo, N. Y.								
18128	Bufceco Hominy Feed	Paterson	10.84	11.38	10.00	7.34	6.00	3.84	5.00
18691	Bufceco Hominy Feed	Caldwell	10.48	11.38	10.00	7.12	6.00	3.15	5.00
	Evans Milling Co., Indianapolis, Ind.								
18818	Evans Pure White Hominy Feed	Jamesburg	9.12	11.44	10.00	6.89	7.50	3.38	7.00
	Chas. A. Krause M'l'g Co., Milwaukee, Wis.								
18003	Badger Hominy Feed	Plainsboro	9.74	11.56	10.00	8.02	6.00	4.20	5.00
18961	Badger Hominy Feed	Bridgeton	9.04	11.13	10.00	7.45	6.00	5.93	5.00
	Miner-Hillard Milling Co., Wilkesbarre, Pa.								
18115	Steam Cooked Hominy Feed	Paterson	9.46	11.25	10.00	6.35	5.00	4.47	5.00
18290	Steam Cooked Hominy Feed	Branchville	7.80	11.19	10.00	6.11	5.00	3.90	5.00
	National Feed Co., St. Louis, Mo.								
18537	Pure Hominy Feed	Hopewell	9.02	11.56	10.50	8.73	8.50	3.53	10.00
	Patent Cereals Co., Geneva, N. Y.								
18554	Hominy Feed	Pennington	8.53	12.38	10.00	6.00	6.00	4.82	5.00
	C. W. Wagar & Co., Philadelphia, Pa.								
18875	Pure Hominy Feed	Columbus	8.29	11.31	9.00	9.15	6.50	5.12	7.00
	Walters Milling Co., Philadelphia, Pa.								
180050	White Hominy Feed	Woodbridge	8.12	9.38	8.00	7.65	3.00	3.42	8.00
	Average	....	8.98	11.26	.....	7.56	.....	4.19	.....

BREWERS' DRIED GRAINS

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
	Atlantic Export Co., New York City.								
18289	Dr. Spund's Dried Brewers' Grains...	Branchville	7.66	24.81	25.00	6.68	6.00	14.52	14.00
18569	Dr. Spund's Dried Brewers' Grains...	Trenton	11.89	21.56	25.00	5.95	6.00	18.19	14.00
	M. F. Baringer, Philadelphia, Pa.								
18110	Dried Brewers' Grains	Paterson	6.59	27.31	25.00	7.57	8.00	14.37	15.00
18316	Dried Brewers' Grains	Halsey	6.48	30.94	25.00	5.27	6.00	12.12	15.00
18293	Crown Brewers' Dried Grains	Branchville	6.50	25.44	25.00	7.13	6.00	14.12	15.00
18780	Crown Brewers' Dried Grains	Plainfield	6.70	27.00	25.00	6.04	6.00	14.50	15.00
	Empire Grain & Elevator Co., Binghamton, N. Y.								
18250	Dried Brewers' Grains	Andover	6.43	16.88	27.50	6.98	6.30	18.42	15.20
	Farmers Feed Co., New York City.								
18005	Bull Brand Dried Brewers' Grains.....	Plainsboro	8.43	15.84	27.20	6.70	6.30	19.15	15.20
18258	Bull Brand Dried Brewers' Grains....	Newton	6.89	26.31	27.20	6.45	6.30	13.81	15.20
	J. C. Klauder, Est., Philadelphia, Pa.								
18048	Dried Brewers' Grains	Camden	8.72	25.75	26.00	6.83	6.00	13.67	15.00
18959	Dried Brewers' Grains	Cookstown	7.55	33.13	26.00	7.67	6.00	10.65	15.00
	G. Krueger Brewing Co., Newark, N. J.								
18356	Dried Brewers' Grains	Murray Hill ...	7.63	24.50	24.00	5.81	6.50	10.74	14.00
	K. & E. Neumond, Inc., St. Louis, Mo.								
18225	Goldnes Kalb Dried Brewers' Grains..	Morristown ...	9.93	23.88	24.00	5.25	6.00	14.08	13.00
	Penn Grains & Feed Co., Philadelphia, Pa.								
18022	Peerless Brewers' Dried Grains	Camden	7.92	26.06	26.00	7.44	6.00	15.27	12.00
18744	Peerless Brewers' Dried Grains	Belle Mead	6.45	22.75	26.00	6.64	6.00	15.50	12.00
	Rosekrans-Snyder Co., Philadelphia, Pa.								
18752	Pilsner Dried Brewers' Grains	Somerville	7.05	20.94	25.00	6.04	5.00	16.96	18.00
	Walters Milling Co., Philadelphia, Pa.								
18503	Brewers' Grains	Flemington	8.13	28.94	24.00	5.93	4.00	11.84	18.00
	Average	....	7.70	24.83	.....	6.49	.....	14.58	.....

DISTILLERS' DRIED GRAINS

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
	(Largely from Corn)								
	American Milling Co., Peoria, Ill.								
18313	Empire State Dairy Feed	Lafayette	6.05	29.88	30.00	11.83	10.00	11.45	14.00
	Atlas Feed & Milling Co., Peoria, Ill.								
18221	Atlas Distillers' Grains	Little Falls	8.29	33.31	30.00	8.38	10.00	10.93	14.00
	Martenis Bros., New York City.								
18536	Atexco Brand Dried Distillers' Grains.	Hopewell	8.03	26.31	26.00	6.17	6.00	12.35	17.00
	S. F. Scattergood & Co., Philadelphia, Pa.								
18311	Cornwell Corn Distillers' Grains	Lafayette	5.74	34.19	30.00	10.05	8.00	10.81	10.00
	Average	....	7.03	30.92	.....	9.11	.....	11.39	.....

DISTILLERS' DRIED GRAINS—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
	(Largely from Rye)								
	J. F. Eby & Son, Lancaster, Pa.								
18140	Corby Dried Grains	Passaic	5.97	18.44	16.00	6.98	5.00	18.33	22.00
	(Dried Yeast Grains from Corn, Rye, Barley Malt and Sprouts, or from Corn, Barley Malt and Sprouts)								
	Fleischmann Co., New York City.								
18146	Fleischmann's Dried Grains—F. M. Co.	Passaic	8.58	19.81	20.00	6.38	7.00	15.55	19.00
18223	Fleischmann's Dried Grains—F. M. Co.	Morristown	5.94	24.31	20.00	8.44	7.00	15.47	19.00
18320	Fleischmann's Dried Grains—I.V.M.Co.	Sussex	5.47	21.00	19.00	6.20	7.00	18.63	19.00
18879	Fleischmann's Dried Grains—I.V.M.Co.	Columbus	7.89	17.50	19.00	5.89	7.00	18.83	19.00
	Average	.....	6.95	20.66	.....	6.73	.....	17.12	.....

MALT SPROUTS

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
	P. Ballantine & Sons, Newark, N. J.								
18264	Malt Sprouts	Netcong	9.53	22.63	22.50	1.45	0.62	11.49	14.95
	Penn Grains & Feed Co., Philadelphia, Pa.								
18538	Malt Sprouts	Hopewell	7.53	24.06	28.76	1.51	1.53	13.18	12.06
	D. R. Worman, Frenchtown, N. J.								
18455	Malt Sprouts	Frenchtown	6.56	26.31	22.00	1.02	0.50	12.95	18.00
	Average	.....	7.88	24.33	.....	1.33	.....	12.54	.....

BUCKWHEAT FEED

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
18303	[1]The Manning Co., Sussex, N. J.	Sussex	11.65	20.56	22.00	5.01	6.30	2.02	2.75
18472	[2]Jos. Smith & Co., Stockton, N. J.	Stockton	14.26	23.19	18.00	5.76	3.00	3.75	15.00
	Average	.....	12.96	21.88	.....	5.39	.....	2.89	.....

[1] Material sold as Buckwheat Middlings.
[2] Material sold as Buckwheat Offal.

BUCKWHEAT MIDDLINGS

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
18314	Armstrong & Demarest, Lafayette, N. J.	Lafayette	13.54	24.50	26.38	6.29	6.52	1.83	2.98
18414	Warren Beaty, Hackettstown, N. J.	Hackettstown	13.96	26.94	30.00	6.97	7.00	1.64	6.00
18381	[1]G. W. Fisher, Port Murray, N. J.	Port Murray	12.85	34.63	32.00	8.76	9.00	3.72	4.00
18383	G. W. Fisher, Port Murray, N. J.	Port Murray	14.34	30.19	23.00	7.60	6.00	2.58	1.00
18498	[2]Flemington Jct. Cereal & Flour Mill, Flemington, N. J.	Flemington	13.30	27.44	24.00	6.47	7.00	4.42	5.00
18395	I. B. Keener, Belvidere, N. J.	Belvidere	12.72	27.50	26.38	6.72	6.86	4.46	5.27
18427	[1]Messler & Shannon, Blairstown, N. J.	Blairstown	11.94	34.56	30.94	9.34	8.60	4.54	4.19
18413	[2]Chas. C. Ort, Hackettstown, N. J.	Hackettstown	12.15	33.50	5.00	8.12	2.00	5.27	30.00

BUCKWHEAT MIDDLINGS—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
18405	Wilbert Stires, Bridgeville, N. J.	Bridgeville	11.92	35.44	22.00	9.11	6.00	2.66	6.00
18450	W. & W. E. Thomas, Milford, N. J.	Milford	14.64	26.06	29.30	6.54	6.50	3.86	5.10
18403	E. J. Vusler, Hope, N. J.	Hope	11.62	34.06	24.49	8.70	6.47	3.80	2.30
18418	[3]J. S. Wiseburn & Son, Stephensburg, N. J.	Stephensburg	11.95	36.69	15.00	9.68	5.00	10.91	25.00
18458	D. R. Worman, Frenchtown, N. J.	Frenchtown	14.65	26.31	30.00	6.48	7.00	2.02	6.00
18459	[4]D. R. Worman, Frenchtown, N. J.	Frenchtown	12.39	31.56	18.31	7.97	2.80	9.30	16.00
	Average		13.00	30.64	....	7.77	....	4.36	....

[1]Material sold as Buckwheat Bran.
[2]Material sold as Buckwheat Offal.
[3]Material sold as Buckwheat Offal—not included in the average.
[4]Material sold as Buckwheat Bran—not included in the average.

BUCKWHEAT OFFAL

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
18509	Frank Bird, Flemington, N. J.	Flemington	7.68	18.00	16.00	5.72	4.00	14.70	15.00
18542	L. W. Dorland, High Bridge, N. J.	High Bridge	11.44	18.13	24.31	4.47	1.24	19.53	3.04
18517	[1]G. G. MacPherson, Lebanon, N. J.	Lebanon	13.57	19.00	15.00	4.70	4.50	18.03	6.00
18917	Reece & Greenly, Millville, Pa.	Mt. Holly	12.55	16.44	10.00	4.33	2.00	22.13	35.00
18521	W. H. Reger & Son, White House, N. J.	White House	12.31	24.81	20.38	6.10	3.50	11.34	11.58
18384	J. A. Tiger, Califon, N. J.	Califon	12.36	22.56	14.00	5.84	4.00	6.53	25.64
18170	[2]Wolff Bros., Paterson, N. J.	Paterson	7.32	16.19	16.00	3.93	4.00	20.42	16.00
	Average		11.03	19.30	....	5.01	....	16.10	....

[1]Material sold as Buckwheat Feed.
[2]Material sold as Buckwheat Grits Feed.

CORN BRAN

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
18701	A. Cyphers Co., Newark, N. J. Ground Corn Bran	Newark	10.59	9.50	8.00	5.30	5.00	10.82	13.00
18872	C. W. Wagar & Co., Philadelphia, Pa. Middlesex White Corn Bran	Columbus	9.81	9.25	7.00	6.68	4.00	9.29	15.00
	Average		10.20	9.38	....	5.99	....	10.06	....

CORN FEED MEAL

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
18491	Geo. C. Higgins & Son, Three Bridges, N. J.	Three Bridges	11.27	8.19	8.94	4.09	4.15	1.63	1.23
18367	Geo. F. Hill & Co., Gladstone, N. J.	Gladstone	11.79	8.06	7.20	4.40	2.80	1.73	2.90
18203	Kasco Mills, Waverly, N. Y.	Westwood	11.77	9.75	9.00	3.73	3.75	2.18	3.00
18103	Phelps & Sibley Co., Cuba, N. Y.	Palisade Park	10.81	10.06	9.00	5.93	3.50	3.29	2.50
18685	Est. H. L. Pierson, Maplewood, N. J.	Maplewood	11.23	9.63	7.75	3.63	3.25	2.27	2.00
180056	H. G. Werner, Deans, N. J.	Deans	13.94	7.88	8.31	4.19	3.43	1.08	1.70
18846	F. D. Wikoff Co., Red Bank, N. J.	Red Bank	11.91	11.00	8.56	7.21	4.40	1.95	0.91
18365	Vernon Wortman, Pottersville, N. J.	Pottersville	11.73	8.38	8.00	5.03	4.00	1.95	3.00
	Average		11.81	9.12	....	4.76	....	2.01	....

CORN AND COB MEAL

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein		Fat		Fiber	
				Found	Guaranteed	Found	Guaranteed	Found	Guaranteed
18416	Warren Beaty, Hackettstown, N. J.	Hackettstown	10.34	7.25	7.00	2.73	3.00	7.26	10.00
18546	Clinton Mills, Clinton, N. J.	Clinton	11.41	5.19	6.00	3.76	3.00	4.97	5.00
18429	Thos. Craig, Buttzville, N. J.	Buttzville	10.72	7.06	6.00	3.57	3.00	5.51	10.00
18390	Geo. W. Fisher, Port Murray, N. J.	Port Murray	10.40	7.94	6.00	3.51	2.50	4.76	6.00
18471	W. F. Hummer, Mt. Pleasant, N. J.	Mt. Pleasant	12.42	8.00	7.55	3.70	2.80	5.55	3.9
18440	W. I. Jacoby, Finesville, N. J.	Finesville	14.93	7.44	7.83	3.38	2.94	4.63	4.9
18515	G. G. MacPherson, Lebanon, N. J.	Lebanon	11.61	8.00	8.00	3.82	3.26	3.96	4.8
18378	Neighbor & Son, Califon, N. J.	Califon	12.55	7.06	7.00	3.26	3.00	7.38	7.00
18435	J. L. Riegel & Son, Riegelsville, N. J.	Riegelsville	11.54	8.44	6.31	3.63	2.29	4.43	7.3
18404	Wilbert Stires, Bridgeville, N. J.	Bridgeville	12.26	7.13	6.00	3.19	2.00	7.16	12.00
18388	J. A. Tiger, Califon, N. J.	Califon	11.98	7.88	6.00	3.66	2.00	4.72	12.00
18401	E. J. Vusler, Hope, N. J.	Hope	11.09	8.19	7.00	3.84	3.50	3.44	7.00
18419	J. S. Wiseburn & Son, Stephensburg, N. J.	Stephensburg	12.89	7.63	7.00	3.31	3.00	5.23	10.00
18366	V. Wortman, Pottersville, N. J.	Pottersville	11.22	7.38	5.50	3.83	2.20	5.19	6.50
	Average	....	11.81	7.40	.....	3.51	.....	5.30	.....

CORN AND OATS

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
180008	S. Anderson, Hammonton, N. J.	Hammonton	11.77	10.00	9.00	4.73	4.00	3.73	5.00
18463	Bodine & Co., Pittstown, N. J.	Pittstown	10.52	9.25	9.50	5.89	4.00	3.66	2.50
18784	Commercial Mill & Elevator, Plainfield, N. J.	Plainfield	10.50	10.25	10.50	4.41	3.00	2.29	4.00
18466	E. H. Deats, Pittstown, N. J.	Pittstown	11.64	9.06	9.00	4.47	4.00	3.07	3.50
18654	N. Drake, Newark, N. J.	Newark	10.55	10.50	10.00	4.63	4.00	2.84	4.00
18500	Alvin Hill & Son, Flemington, N. J.	Flemington	10.76	11.31	9.00	3.91	3.50	5.09	7.00
18512	B. Huffman, Ringoes, N. J.	Ringoes	11.15	8.69	8.00	4.57	3.50	1.99	4.00
18468	W. F. Hummer, Mt. Pleasant, N. J.	Mt. Pleasant	11.99	9.69	8.40	4.01	3.20	3.86	3.80
18963	R. S. Johnson, Bridgeton, N. J.	Bridgeton	10.65	9.81	10.13	5.34	4.44	4.59	2.58
18480	Lambert & Kerr, Lambertville, N. J.	Lambertville	11.55	9.06	10.00	4.37	4.00	2.57	7.00
18838	V. T. Miller, Manasquan, N. J.	Manasquan	12.18	11.25	9.00	3.91	3.00	2.29	4.00
18236	Geo. Q. Moon & Co., Binghamton, N. Y.	Morristown	11.34	10.25	8.50	4.29	4.50	4.95	9.00
18205	Oradell Flour, Feed & Grain Co., Oradell, N. J.	Oradell	11.35	10.25	9.75	3.81	3.41	3.21	4.23
18686	Est. of H. L. Pierson, Maplewood, N. J.	Maplewood	10.99	10.56	8.00	4.58	3.00	3.68	4.75
18497	A. S. Rockafellow, Flemington, N. J.	Flemington	11.37	10.06	9.00	4.06	4.00	2.85	4.50
180059	W. Schlesinger, New Brunswick, N. J.	New Brunswick	11.54	9.44	9.70	3.42	3.60	2.13	2.35
18844	Stonaker & Casey, Jamesburg, N. J.	Jamesburg	10.94	11.81	9.00	4.45	3.50	4.55	2.00
18045	Taylor Bros., Camden, N. J.	Camden	11.22	9.81	9.00	5.12	4.00	3.51	5.00
18745	Union Grain Co., Plainfield, N. J.	Plainfield	10.72	11.00	10.06	4.46	4.64	3.00	2.90
18847	F. D. Wikoff Co., Red Bank, N. J.	Red Bank	11.41	10.75	9.00	4.23	3.50	4.43	8.50
18836	M. G. & A. P. Wyckoff Co., Manasquan, N. J.	Manasquan	10.13	11.19	10.00	5.29	4.50	4.67	5.50
18755	W. H. H. Wyckoff Co., Somerville, N. J.	Somerville	13.35	8.56	8.00	3.33	3.00	3.43	7.50
	Average	....	11.25	10.57	.....	4.42	.....	3.47	.....

RYE BRAN

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein		Fat		Fiber	
				Found	Guaranteed	Found	Guaranteed	Found	Guaranteed
3950	F. R. Boyd, Medford, N. J.	Medford	11.77	14.65	12.00	2.29	2.50	4.38	5.00
3465	E. H. Deats, Pittstown, N. J.	Pittstown	11.30	15.31	13.00	2.44	2.50	4.88	6.00
3900	Garden City M'l'g Co., Bordentown, N. J.	Bordentown	10.61	16.44	13.50	2.78	2.55	3.78	4.30
3633	J. P. Golden & Son, Yardville, N. J.	Yardville	11.65	17.31	13.00	2.93	2.60	4.59	7.00
3811	Gross Bros., Hightstown, N. J.	Freehold	11.78	14.00	13.36	2.55	2.62	5.18	4.36
3605	Howell & Sons, Trenton, N. J.	Lawrence	11.45	16.81	13.75	2.65	2.25	5.28	4.50
3866	Hutchinson Bros., Crosswicks, N. J.	Crosswicks	12.48	16.06	14.94	2.92	3.03	5.20	4.38
3857	Geo. H. Kirby, Allentown, N. J.	Allentown	13.25	15.38	13.00	2.80	3.19	4.49	3.93
3889	Wm. Kirby, Etra, N. J.	Etra	12.60	15.25	12.50	2.17	1.82	3.10	5.00
3944	Kirby Bros, Medford, N. J.	Medford	11.67	15.44	13.75	2.31	2.25	4.29	4.50
3942	Ridgeway Bros., Pemberton, N. J.	Pemberton	12.99	13.69	12.31	2.24	3.64	3.20	4.60
3775	Union Mills Co., Neshanic, N. J.	Neshanic	12.04	15.63	13.00	2.40	2.00	4.66	7.00
054	H. G. Werner, Deans, N. J.	Deans	12.58	15.25	12.38	2.24	2.29	3.97	2.72
3460	D. R. Worman, Frenchtown, N. J.	Frenchtown	11.29	16.13	13.50	2.67	2.50	5.27	5.25
	Average	....	11.96	15.53	.....	2.53	.....	4.45	.....

RYE MIDDLINGS

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
888	A. K. Ashby, Burlington, N. J.	Burlington	12.43	14.94	.....	2.53	.....	3.10	.....
948	F. R. Boyd, Medford, N. J.	Medford	12.60	11.63	11.00	2.26	2.25	2.37	2.50
808	Burtis, Conine & Son, Allentown, N. J.	Freehold	13.27	13.88	10.50	2.42	3.00	3.32	4.00
464	E. H. Deats, Pittstown, N. J.	Pittstown	12.74	13.94	12.31	2.37	2.50	2.52	3.77
412	Flory Milling Co., Bangor, Pa.	Stephensburg	10.18	14.81	13.00	2.94	3.00	3.74	9.00
901	Garden City M'l'g Co., Bordentown, N. J.	Bordentown	10.99	14.88	10.50	2.74	2.20	3.04	2.15
632	J. P. Golden & Son, Yardville, N. J.	Yardville	12.62	13.44	11.00	2.24	2.25	2.37	3.00
839	Gross Bros., Hightstown, N. J.	Manasquan	11.73	16.06	9.66	2.83	1.82	4.28	1.32
603	Howell & Sons, Trenton, N. J.	Lawrence	11.70	15.44	12.50	2.78	2.20	4.39	2.75
865	Hutchinson Bros., Crosswicks, N. J.	Crosswicks	12.65	14.81	10.63	2.94	2.30	3.04	2.03
856	Geo. H. Kirby, Allentown, N. J.	Allentown	12.85	12.94	11.69	2.68	3.07	4.04	2.75
890	Wm. Kirby, Etra, N. J.	Etra	12.72	15.44	10.38	3.11	1.75	3.49	3.00
943	Kirby Bros., Medford, N. J.	Medford	12.11	12.13	10.00	2.11	2.00	2.95	2.50
331	Miner-Hillard M'l'g Co., Wilkesbarre, Pa.	Hamburg	11.21	16.19	12.00	3.13	2.50	3.78	5.00
941	Ridgeway Bros., Pemberton, N. J.	Pemberton	13.32	11.38	8.75	1.88	2.11	1.69	1.41
776	Union Mills Co., Neshanic, N. J.	Neshanic	12.85	14.13	12.00	2.93	2.00	2.87	4.00
938	Woodward Bros., Cookstown, N. J.	Cookstown	13.23	11.19	10.00	1.72	2.00	1.79	2.50
912	S. C. Woolman & Co., Philadelphia, Pa.	Mt. Holly	8.51	16.03	16.00	3.49	3.40	5.65	8.00
055	H. G. Werner, Deans, N. J.	Deans	14.25	12.50	11.63	2.18	2.14	2.27	2.82
461	D. R. Worman, Frenchtown, N. J.	Frenchtown	12.74	15.00	8.31	2.64	2.25	2.62	3.00
	Average	....	12.24	14.04	.....	2.60	.....	3.17	.....

WHEAT BRAN

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein		Fat		Fiber	
				Found	Guaranteed	Found	Guaranteed	Found	Guaranteed
	M. F. Baringer, Philadelphia, Pa.								
18315	Pure Wheat Bran	Halsey	9.86	15.25	15.50	4.65	4.50	8.10	12.00
180014	[1]Wheat Bran	Mullica Hill	10.61	13.96	15.00	3.69	4.00	10.35	10.00
	Bay State Milling Co., Winona, Minn.								
18332	Winona Coarse Wheat Bran	Hamburg	9.17	15.81	15.00	5.59	4.50	9.83	12.00
	Belvidere Flouring Mills Co., Belvidere, N. J.								
18398	Wheat Bran	Belvidere	10.81	17.00	8.00	4.24	2.00	7.99	15.00
	Big Diamond Mills Co., Minneapolis, Minn.								
180043	[1]Big Diamond Wheat Bran	South River	10.28	13.63	14.00	4.78	4.00	12.25	11.00
	Blaisdell Milling Co., Minneapolis, Minn.								
18931	[1]Wheat Bran	Moorestown	10.88	14.44	13.00	5.45	4.00	10.94	13.00
	Burtis, Conine & Son, Allentown, N. J.								
18854	Wheat Bran	Allentown	12.03	14.13	12.00	3.31	4.00	9.73	7.00
	L. G. Campbell M'l'g Co., Owatonna, Minn.								
18803	Pure Wheat Bran	Elizabeth	9.83	14.13	13.40	5.31	4.50	10.02	12.20
	Clinton Mills, Clinton, N. J.								
18548	Wheat Bran	Clinton	9.81	17.19	13.00	3.95	4.00	7.76	8.25
	Commander Mill Co., Minneapolis, Minn.								
180001	[1]Wheat Bran	Camden	10.41	14.44	14.00	5.23	4.00	10.75	11.00
	J. G. Davis Co., Rochester, N. Y.								
18357	Granite Wheat Bran	Murray Hill	9.30	16.00	13.00	5.41	3.00	10.05	12.00
	J. Sanford Davis, Greenwich, N. J.								
18969	Soft Winter Wheat Bran	Greenwich	11.20	14.25	14.00	4.47	4.50	7.99	7.50
	L. W. Dorland, High Bridge, N. J.								
18543	Wheat Bran	High Bridge	11.97	16.25	14.19	2.94	4.10	6.73	6.51
	Duluth-Superior Milling Co., Duluth, Minn.								
18488	[1]Duluth Imperial Bran	Lambertville	9.64	15.13	14.50	5.71	3.75	12.25	11.90
	B. A. Eckhart Milling Co., Chicago, Ill.								
18297	[1]Wheat Bran	Branchville	7.44	15.19	14.00	4.79	4.00	9.34	11.00
	Ewen Milling Co., Alloway, N. J.								
18981	Wheat Bran	Alloway	11.70	14.75	15.25	3.42	4.25	8.61	7.50
	Flemington Milling Co., Flemington, N. J.								
18506	Wheat Bran	Flemington	10.06	15.13	12.50	3.12	3.74	7.76	9.26
	Flory Milling Co., Bangor, Pa.								
18408	Pure Wheat Bran	Hope	9.44	14.81	12.00	5.09	3.00	10.28	12.00
	G. F. Geisinger, Bridgeton, N. J.								
18972	Wheat Bran	Bridgeton	11.05	13.94	14.44	3.63	4.23	8.87	7.25
	J. H. Grover & Son, Princeton Jct., N. J.								
18582	Wheat Bran	Princeton Jct.	10.91	15.63	13.50	4.83	3.50	9.60	12.00
	Hecker-Jones-Jewell M'l'g Co., N. Y. City.								
18665	[1]Choice Bran	Newark	9.71	15.50	14.25	4.75	4.00	9.87	11.00
	G. C. Higgins & Son, Three Bridges, N. J.								
18493	Wheat Bran	Three Bridges	8.92	14.69	14.00	3.03	4.00	7.99	3.00
	Howell & Sons, Trenton, N. J.								
18604	Wheat Bran	Lawrence	10.98	16.13	14.00	3.35	4.00	7.61	12.00
	Hunter-Robinson-Wenz Milling Co., St. Louis, Mo.								
18860	[1]Dreadnought Wheat Bran	Red Bank	9.07	14.19	15.50	3.67	4.00	7.87	11.00

[1]With ground screenings not exceeding mill run.

WHEAT BRAN—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
	E. C. Hutchinson M'l'g Co., Trenton, N. J.								
18591	Wheat Bran	Trenton	11.09	17.19	14.00	3.96	4.00	7.39	10.00
	W. J. Jennison Co., Minneapolis, Minn.								
18779	[1]Wheat Bran	Neshanic Sta.	9.66	14.44	14.00	4.38	4.00	10.85	12.00
	R. S. Johnson, Bridgeton, N. J.								
18964	Wheat Bran	Bridgeton	11.63	14.06	13.56	3.75	4.36	10.28	8.92
	Johnson Bros., Bridgeton, N. J.								
18966	Wheat Bran	Bridgeton	12.22	13.69	13.38	3.33	3.95	8.46	9.91
	M. B. Jones & Co., New York City.								
18197	Wheat Bran	Boonton	8.43	14.94	14.00	4.24	3.00	10.84	7.00
	Kemper Mill & Elevator Co., Kansas City, Mo.								
18249	[1]Anchor Bran	Andover	8.54	17.38	14.50	4.01	4.00	8.48	10.00
	Geo. H. Kirby, Allentown, N. J.								
18859	Wheat Bran	Allentown	11.87	13.88	13.13	3.53	4.53	7.40	6.71
	Kirby Bros., Medford, N. J.								
18945	Wheat Bran	Medford	11.73	14.69	13.00	3.51	4.00	7.96	9.00
	H. W. Koch & Co., Philadelphia, Pa.								
18962	Robin Hood Wheat Bran	Bridgeton	9.66	16.44	14.30	5.33	4.20	11.15	12.00
	Listman Mill Co., LaCrosse, Wis.								
180020	Elmco Wheat Bran	Vineland	10.91	15.81	14.90	5.15	3.80	9.11	12.00
	Martenis Bros., New York City.								
18551	[1]M. Bros. Wheat Bran	Pennington	10.83	14.56	13.00	4.82	3.50	11.13	12.00
	Mauser Mill Co., Treichlers, Pa.								
18451	[1]Pure Wheat Bran	Frenchtown	9.35	15.44	14.00	4.09	5.00	7.51	9.00
	McMurtrie Milling Co., Belvidere, N. J.								
18393	Wheat Bran	Belvidere	9.93	15.63	10.00	3.96	2.00	8.05	10.00
	Millbourne Mills, Philadelphia, Pa.								
18820	Pure Wheat Bran	Jamesburg	9.57	15.63	15.00	4.03	4.00	9.16	10.00
	Millville Flour & Grain Co., Millville, N. J.								
180031	Wheat Bran	Millville	11.55	11.94	11.00	4.18	3.50	8.80	8.00
	Geo. B. Mitchell, Swedesboro, N. J.								
18007	Wheat Bran	Swedesboro	11.48	13.88	.....	4.13	.....	10.52	.....
	Northwestern Consolidated Milling Co., Minneapolis, Minn.								
18100	Pure Wheat Bran	Palisades Park.	9.98	14.56	14.50	5.38	4.00	10.58	11.00
	Pillsbury Flour Mills Co., Minneapolis, Minn.								
18239	[1]Pillsbury Wheat Bran	Morristown	10.81	13.95	13.00	4.64	4.00	10.52	13.00
18688	[1]Pillsbury Durum Wheat Bran	Caldwell	8.36	14.13	11.00	6.44	4.00	13.34	14.00
	Quaker City Flour Mills Co., Phila., Pa.								
18043	[1]Winter Wheat Bran	Camden	8.60	13.88	13.00	4.36	3.00	9.69	10.50
	Red Wing Milling Co., Red Wing, Minn.								
18322	[1]Bixota Wheat Bran	Sussex	8.74	13.19	13.90	5.44	3.60	11.99	13.60
	W. H. Reger & Son, White House, N. J.								
18525	Wheat Bran	White House	10.18	16.69	13.50	3.59	3.18	7.27	7.05
	J. L. Riegel & Son, Riegelsville, N. J.								
18438	Wheat Bran	Riegelsville	9.00	14.94	12.19	3.74	2.81	9.58	9.30

[1]With ground screenings not exceeding mill run.

WHEAT BRAN—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein		Fat		Fiber	
				Found	Guaranteed	Found	Guaranteed	Found	Guaranteed
	A. S. Rockafellow, Flemington, N. J.								
18496	Wheat Bran	Flemington	11.59	16.25	14.00	3.77	4.00	7.48	8.0
	Rosekrans-Snyder Co., Philadelphia, Pa.								
18649	Wheat Bran	Newark	10.05	14.50	12.00	3.17	3.00	8.33	12.0
	Russell-Miller Milling Co., Minneapolis, Minn.								
18215	Wheat Bran	Little Falls	8.26	15.31	13.00	4.60	4.00	10.48	11.0
	B. F. Schwartz Co., New York City.								
18070	[1]Wheat Bran	Hackensack	10.15	13.25	13.00	4.85	4.00	11.60	15.0
	J. Smith & Co., Stockton, N. J.								
18473	Wheat Bran	Stockton	9.13	16.25	14.00	3.13	4.00	9.25	9.0
	T. C. Souder & Son, Millville, N. J.								
180026	Wheat Bran	Millville	8.80	15.44	14.00	4.17	3.50	9.53	12.0
	Star & Crescent Milling Co., Chicago, Ill.								
18133	[1]Star Bran	Paterson	8.96	14.50	15.00	4.33	4.00	10.59	10.0
18880	[1]Crescent Winter Wheat Bran	Columbus	9.19	14.44	15.00	3.41	4.00	9.51	10.0
	W. W. Supplee, Hampton, N. J.								
18420	Wheat Bran	Hampton	10.37	17.19	14.00	3.05	4.00	8.11	8.0
	W. & W. E. Thomas, Milford, N. J.								
18447	Wheat Bran	Milford	9.04	15.31	13.50	3.62	4.10	8.32	7.5
	A. Thompson & Co., Trenton, N. J.								
18580	Wheat Bran	Trenton	11.22	20.44	14.50	5.03	4.50	6.41	8.5
	J. A. Tiger, Califon, N. J.								
18387	Wheat Bran	Califon	10.61	14.94	12.00	3.36	3.00	8.22	8.00
	Union Mills Co., Neshanic, N. J.								
18777	Wheat Bran	Neshanic	10.90	14.75	13.75	3.08	4.00	9.52	11.00
	Geo. Urban Milling Co., Buffalo, N. Y.								
18232	[1]Wheat Bran	Morristown	9.16	15.38	14.00	5.43	3.50	10.33	12.50
	Washburn-Crosby Co., Minneapolis, Minn.								
18089	[1]Wheat Bran	Englewood	9.40	14.06	13.00	4.59	4.00	10.45	13.00
	Western Star Mill Co., Salina, Kan.								
18263	Star Winter Wheat Bran with Screenings	Netcong	7.35	18.56	15.00	4.14	3.50	8.41	11.00
	F. C. Williams, Easton, Pa.								
18252	Wheat Bran	Andover	8.99	16.00	14.00	4.96	4.30	7.94	10.00
	S. C. Woolman & Co., Philadelphia, Pa.								
18845	Spring Wheat Bran	Red Bank	10.10	14.44	14.50	4.66	4.00	11.64	11.00
18974	[1]Seal of Minnesota Wheat Bran	Bridgeton	8.74	15.13	13.30	5.21	3.00	11.12	11.25
	W. H. H. Wyckoff Co., Somerville, N. J.								
18754	Wheat Bran	Somerville	11.09	14.38	11.00	3.60	3.00	9.17	10.00
	S. H. Young & Co., Philadelphia, Pa.								
18823	[1]Wheat Bran	Spotswood	9.14	14.38	14.00	5.44	4.00	11.27	11.00
	Average	....	10.01	15.11	.....	4.29	.....	9.42	.....

[1]With ground screenings not exceeding mill run.

WHEAT MIDDLINGS

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
	M. F. Baringer, Philadelphia, Pa.								
18004	Rex White Middlings	Plainsboro	10.89	15.69	16.00	4.97	5.50	6.36	10.00
180002	Wheat Middlings	Woodstown	12.37	16.25	....	4.98	....	4.26	....
	Bay State Milling Co., Winona, Minn.								
18333	Winona Fancy White Flour Middlings	Hamburg	10.28	15.88	16.00	3.91	4.50	1.43	2.50
	Belvidere Flouring Mill Co., Belvidere, N. J.								
18399	Wheat Middlings	Belvidere	11.18	16.31	8.00	4.16	2.00	4.41	10.00
	Big Diamond Mills Co., Minneapolis, Minn.								
18148	[1]Big Diamond Flour Middlings	Passaic	10.13	17.00	14.50	5.47	4.50	5.25	7.76
	Buffalo Cereal Co., Buffalo, N. Y.								
18118	Wheat Flour Middlings	Rutherford	10.79	16.19	16.00	4.67	4.50	5.38	8.00
	Burtis, Conine & Son, Allentown, N. J.								
18853	Wheat Middlings	Allentown	12.51	15.69	13.00	3.96	4.00	5.38	2.00
	Bushkill Milling Co., Easton, Pa.								
18446	Pure Middlings	Phillipsburg	11.06	16.25	....	3.50	....	4.06	....
	Clinton Mills, Clinton, N. J.								
18545	Wheat Middlings	Clinton	10.74	15.69	12.00	3.55	3.50	2.62	3.00
	Commander Mill Co., Minneapolis, Minn.								
18196	[1]Commander Standard Middlings	Boonton	10.73	16.56	15.00	5.66	4.00	7.23	9.00
18343	[1]Wheat Flour Middlings	Bernardsville	9.83	18.06	16.00	5.97	4.50	5.61	7.00
	J. G. Davis Co., Rochester, N. Y.								
18358	Granite Wheat Middlings	Murray Hill	10.18	17.14	15.00	5.66	4.50	4.87	10.00
	J. Sanford Davis, Greenwich, N. J.								
18970	Fancy White Middlings	Greenwich	12.71	15.06	10.00	4.74	1.00	2.38	1.00
18971	Brown Wheat Middlings	Greenwich	12.27	15.00	14.00	5.27	4.50	3.40	2.30
	Duluth-Superior Milling Co., Duluth, Minn.								
18749	"S" Middlings	Somerville	10.57	17.00	16.50	5.56	4.70	6.49	8.10
	J. W. Eshelman, Lancaster, Pa.								
18827	[1]Wheat Middlings	Long Branch	12.14	14.81	15.00	3.40	5.00	3.36	9.00
	Everett, Aughenbaugh & Co., Waseca, Minn.								
18848	[1]Eaco Wheat Middlings	Red Bank	10.94	17.88	15.00	5.86	3.00	6.55	10.00
	Ewen Milling Co., Alloway, N. J.								
18982	Wheat Middlings	Alloway	12.44	16.81	14.00	4.83	3.18	4.72	2.42
	A. J. Faulkner, New York City.								
18578	Standard Wheat Middlings	Trenton	9.65	16.56	15.44	3.73	4.24	10.63	11.00
	Flemington Milling Co., Flemington, N. J.								
18504	Wheat Middlings	Flemington	10.53	16.50	13.50	4.27	3.51	4.72	4.26
	Flory Milling Co., Bangor, Pa.								
18409	Pure Wheat Middlings	Hope	10.35	16.13	13.00	4.74	3.00	3.84	9.00
	T. D. Fritch & Sons, Bethlehem, Pa.								
18380	Wheat White Middlings	Califon	9.86	16.44	13.00	4.16	3.00	5.46	9.00
	G. F. Geisinger, Bridgeton, N. J.								
18976	Wheat Middlings	Bridgeton	12.34	16.00	15.69	5.36	4.72	3.55	2.58
	Globe Elevator Co., Buffalo, N. Y.								
18107	Fancy White Middlings	Fort Lee	9.76	15.13	13.00	4.26	3.00	5.72	5.00
18269	Flour Middlings	Dover	9.05	15.69	12.00	4.28	3.00	5.33	9.00
	J. H. Grover & Son, Princeton Jct., N. J.								
18581	Wheat Middlings	Princeton Jct.	10.50	17.25	14.50	5.91	4.50	4.69	7.00

[1]With ground screenings not exceeding mill run.

WHEAT MIDDLINGS—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
	Hecker, Jones-Jewell Milling Co., Buffalo, N. Y.								
18124	[1]Standard Middlings	Paterson	9.31	17.13	16.00	6.15	4.75	7.89	9.25
	Hecker-Jones-Jewell Milling Co., N. Y. City.								
18738	Fancy Flour Middlings	Jersey City	9.84	17.63	15.75	4.89	4.75	4.83	5.50
18739	[1]"H" Middlings	Jersey City	10.45	16.81	15.50	5.03	4.75	7.73	8.00
	G. C. Higgins & Son, Three Bridges, N. J.								
18492	Wheat Middlings	Three Bridges	9.97	16.69	14.05	4.93	3.00	3.46	6.00
	Howell & Sons, Trenton, N. J.								
18602	Wheat Middlings	Lawrence	11.40	17.06	15.00	4.11	4.00	5.95	9.50
	E. C. Hutchinson Milling Co., Trenton, N. J.								
18590	Wheat Middlings	Trenton	12.89	15.19	15.00	2.96	3.00	7.07	4.00
	W. J. Jennison Co., Minneapolis, Minn.								
18772	[1]Wheat Flour Middlings	Bound Brook	11.28	17.19	17.00	5.52	4.50	5.62	5.50
	R. S. Johnson, Bridgeton, N. J.								
18965	Wheat Middlings	Bridgeton	13.31	15.69	16.44	4.65	5.43	5.25	3.09
	Johnson Bros., Bridgeton, N. J.								
18968	Wheat Middlings	Bridgeton	12.69	14.94	15.63	4.03	5.72	2.79	4.60
	G. H. Kirby, Allentown, N. J.								
18858	Wheat Middlings	Allentown	12.42	15.06	13.00	3.56	3.70	2.09	2.03
	H. W. Koch & Co., Philadelphia, Pa.								
18773	[1]Wheat Middlings	Bound Brook	9.17	14.94	16.00	5.42	5.50	10.42	10.00
	McMurtrie Milling Co., Belvidere, N. J.								
18392	Wheat Middlings	Belvidere	9.32	16.50	8.00	4.52	1.05	5.78	2.00
	Millbourne Mills, Philadelphia, Pa.								
18819	[1]Wheat Middlings	Jamesburg	10.23	14.25	16.00	3.94	4.00	3.85	4.00
	Millville Flour & Grain Co., Millville, N. J.								
180030	Wheat Middlings	Millville	12.70	15.06	13.50	5.24	4.50	3.43	3.00
	Geo. B. Mitchell, Swedesboro, N. J.								
18006	Wheat Middlings	Swedesboro	12.18	15.88	.....	5.45	.....	6.62	.....
	Northwestern Consolidated Milling Co., Minneapolis, Minn.								
18006	Wheat Middlings	Freehold	10.17	17.50	15.50	6.59	4.50	6.56	6.00
	Northwestern Eleva'r & Mill Co., Toledo, O.								
18139	[1]Wheat Middlings	Paterson	10.22	15.25	15.00	3.89	4.00	5.55	9.00
	Phelps & Sibley Co., Cuba, N. Y.								
18101	[1]Fancy Wheat Middlings	Homestead	8.91	17.06	15.00	5.40	4.00	6.13	6.00
	Pillsbury Flour Mills Co., Minneapolis, Minn.								
18310	[1]Pillsbury Wheat A Middlings	Sussex	8.93	18.00	15.00	5.10	4.00	5.62	8.00
18317	[1]Pillsbury Wheat Standard Middlings	Sussex	8.47	15.75	14.00	5.41	4.00	9.77	11.00
	Quaker City Flour Mills Co., Phila., Pa.								
18051	Winter Wheat Middlings	Camden	10.33	16.63	14.00	4.74	4.00	5.34	5.50
	Red Wing Milling Co., Red Wing, Minn.								
18323	Bixota Wheat Flour Middlings	Sussex	9.94	17.13	16.20	4.82	4.50	3.48	4.00
	W. H. Reger & Son, White House, N. J.								
18524	Wheat Middlings	White House	10.53	15.63	13.38	3.44	3.04	1.93	1.80

[1]With ground screenings not exceeding mill run.

WHEAT MIDDLINGS—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
	J. L. Riegel & Son, Riegelsville, N. J.								
18436	Wheat Middlings	Riegelsville	11.38	14.56	13.44	4.07	3.15	2.36	3.89
18437	Ship Stuff	Riegelsville	9.88	15.63	13.69	3.89	3.59	7.35	6.10
	A. S. Rockafellow, Flemington, N. J.								
18495	Wheat Middlings	Flemington	12.01	18.88	10.00	5.56	4.00	3.48	5.00
	Rosekrans-Snyder Co., Philadelphia, Pa.								
18650	Wheat Middiings	Newark	10.14	16.03	14.00	4.24	3.00	5.63	10.00
	Russell-Miller Milling Co., Minneapolis, Minn.								
18651	Standard Middlings	Newark	9.94	17.19	15.00	5.89	4.00	7.60	9.00
	S. F. Scattergood & Co., Philadelphia, Pa.								
18750	Wheat Middlings	Somerville	10.30	15.44	16.20	4.63	4.60	4.92	5.00
	B. F. Schwartz & Co., Inc., New York City.								
18710	[1]Wheat Middlings	Newark	10.00	16.13	15.00	5.35	5.00	9.77	9.50
	Shane Bros & Wilson Co., Minneapolis, Minn.								
18481	[1]Snowball Wheat White Middlings	Lambertville	8.99	17.50	15.00	5.51	4.50	6.73	7.00
	Sharpless & Bro., Camden, N. J.								
18028	S & B White Middlings	Camden	10.28	16.81	14.00	4.97	3.00	5.22	8.00
	J. Smith & Co., Stockton, N. J.								
18476	Wheat Middlings	Stockon	10.97	17.25	13.00	5.32	4.00	2.62	7.00
	T. C. Souder & Son, Millville, N. J.								
180027	Wheat Middlings	Millville	10.70	18.00	15.00	4.43	4.00	4.55	9.00
	Star & Crescent Milling Co., Chicago, Ill.								
18134	Crescent White Wheat Middlings	Paterson	9.20	16.25	16.00	5.30	4.50	4.13	6.00
	W. W. Supplee, Hampton, N. J.								
18422	Wheat Middlings	Hampton	11.42	17.75	14.00	4.76	4.00	3.18	8.00
	W. & W. E. Thomas, Milford, N. J.								
18448	Wheat Middlings	Milford	10.90	14.50	12.10	3.55	3.00	2.56	2.00
	A. Thompson & Co., Trenton, N. J.								
18579	Wheat Middlings	Trenton	11.77	16.01	14.50	4.10	3.75	4.68	5.00
	Tioga Mill & Elevator Co., Waverly, N. Y.								
18335	Waverly Flour Wheat Middlings	Hamburg	9.59	16.25	15.00	4.98	4.00	7.12	8.50
	Union Mills Co., Neshanic, N. J.								
18778	Wheat Middlings	Neshanic	11.78	16.00	14.00	4.69	4.00	5.00	8.00
	Western Star Mill Co., Salina, Kan.								
18262	Star Winter Wheat Middlings	Netcong	8.96	16.19	16.00	3.97	4.00	4.68	5.50
	F. C. Williams, Easton, Pa.								
18253	Wheat Middlings	Andover	10.44	18.13	17.00	5.56	7.00	4.01	5.00
	S. H. Young & Co., Philadelphia, Pa.								
18824	[1]Wheat Flour Middlings	Spotswood	10.23	17.50	16.00	5.84	4.50	5.63	7.00
	Average		10.69	16.35	.....	4.77	.....	5.16	.....

[1]With ground screenings not exceeding mill run.

WHEAT FEEDING FLOUR

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
	Northwestern Consolidated Milling Co., Minneapolis, Minn.								
18369	XXX Comet	Far Hills	8.68	17.81	16.50	6.27	4.00	2.27	3.00
	Pillsbury Flour Mills Co., Minneapolis, Minn.								
18142	Pillsbury XX Daisy	Passaic	8.68	18.00	16.00	4.90	4.00	3.34	4.00
	Star & Crescent Milling Co., Chicago, Ill.								
18135	Star Red Dog	Paterson	9.80	15.50	16.50	4.40	4.00	4.09	3.00
	C. W. Wagar & Co., Philadelphia, Pa.								
18849	Red Dog Flour	Red Bank	11.45	17.00	16.75	4.17	4.25	2.30	3.00
	J. D. Walls Co., Philadelphia, Pa.								
18071	Atlas Red Dog	Hackensasck	9.51	18.75	12.00	5.59	4.00	4.46	5.00
	Washburn-Crosby Co., Minneapolis, Minn.								
18121	Adrian Red Dog Flour	Paterson	10.02	16.75	16.00	4.55	4.00	3.09	4.00
	Average		9.69	17.30	....	4.98	....	3.26	....

ALFALFA MEAL

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
	Denver Alfalfa Milling & Products Co., Hartman, Col.								
18482	Alfalfa Meal	Lambertville	8.02	13.44	12.00	1.67	1.50	34.01	35.00
	Albert Dickinson Co., Chicago, Ill.								
18746	Alfalfa Meal	Plainfield	8.07	15.63	12.00	1.66	1.00	27.26	35.00
	Ezl. Dunwoody Co., Philadelphia, Pa.								
180029	Pure Alfalfa Meal	Millville	7.98	14.31	14.00	1.64	2.00	27.18	30.00
	Hales & Edwards Co., Chicago, Ill.								
180009	Red Comb Alfalfa Meal	Vineland	9.70	12.25	13.50	1.23	1.00	33.41	35.00
	Meader-Atlas Co., New York City.								
18204	Purestock Alfalfa Meal	Oradell	8.31	14.88	12.00	1.78	1.00	29.45	33.00
	Neustadt & Co., New York City.								
18690	Red Star Brand California Alfalfa Meal	Caldwell	7.66	18.19	15.00	1.56	1.40	23.66	29.50
	Nowak Milling Corporation, Buffalo, N. Y.								
18272	Domino Alfalfa Meal	Rockaway	7.49	16.81	10.00	1.62	1.00	26.61	35.00
	Omaha Alfalfa Milling Co., Omaha, Neb.								
18068	Alfalfa Meal	Hackensack	9.45	14.63	12.00	1.57	1.00	25.25	30.00
	Park & Pollard Co., Boston, Mass.								
18285	Alfalfa Meal	Dover	7.89	20.19	12.00	1.88	1.50	23.43	30.00
	J. C. Smith & Wallace Co., Newark, N. J.								
18662	Alfalfa Meal	Newark	7.64	11.94	15.31	1.42	1.98	30.60	25.33
	Somers & Co., San Francisco, Cal.								
18042	Red Star Brand Alfalfa Meal	Camden	7.41	17.25	15.00	1.67	1.40	30.28	29.50
	Otto Weiss Milling Co., Wichita, Kan.								
18150	Alfalfa Meal	Paterson	7.00	14.06	14.00	1.47	1.50	27.30	35.00
	Average		8.05	15.30	....	1.60	....	28.20	....

DRIED BEET PULP

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
	Hottelet Co., Milwaukee, Wis.								
18998	Dried Beet Pulp	Camden	5.88	10.31	8.00	0.65	0.50	19.90	20.00
30052	Dried Beet Pulp	Perth Amboy ..	9.53	8.81	8.00	0.84	0.50	20.27	20.00
	Larrowe Milling Co., Detroit, Mich.								
18574	Dried Beet Pulp	Princeton Jct. .	9.72	9.31	8.00	0.57	0.50	19.79	20.00
18789	Dried Beet Pulp	Townley	8.16	8.31	8.00	0.64	0.50	18.78	20.00
	Maritime Trading Corporation, N. Y. City.								
30016	Bull Brand Dried Beet Pulp	Mullica Hill ...	8.27	8.81	8.00	0.60	0.50	18.95	20.00
	Average	....	8.31	9.11	.....	0.66	.....	19.54	.....

COCOANUT MEAL

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
	American Milling Co., Peoria, Ill.								
18867	Pure O. P. Cocoanut Meal	Bordentown ...	5.89	22.44	20.00	7.03	6.00	10.27	11.00
	Neustadt & Co., New York City.								
18828	Cocoanut Oil Meal	Long Branch ..	16.32	18.81	20.00	4.94	3.00	9.45	15.00
	Oil Seeds Co., Bayonne, N. J.								
18346	Coco Brand Cocoanut Meal	Bernardsville ..	9.56	18.75	20.00	12.44	7.00	9.01	10.00
	Average	....	10.59	20.00	.....	8.14	.....	9.58	.....

COPRA CAKE MEAL

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
	American Milling Co., Peoria, Ill.								
18453	Copra Meal	Frenchtown ...	6.31	20.56	20.00	9.20	6.00	9.56	11.00
	M. F. Baringer, Philadelphia, Pa.								
18930	Copra Cake Meal	Moorestown ...	8.49	20.44	21.00	8.02	6.00	9.74	10.00
	Average	....	7.40	20.50	.....	8.61	.....	9.65	.....

PEANUT OIL MEAL

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed
	Oil Seeds Co., Bayonne, N. J.								
18494	Peanut Oil Meal—Beta Brand	Three Bridges .	7.40	29.81	30.00	12.12	7.00	9.11	8.00

OAT FEED

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed	Principal Ingredients Guaranteed
18038	Anderson Grain Co., Buffalo, N. Y. Fancy Canada Oat Feed	Blairstown	7.65	2.31	5.25	0.81	2.33	29.87	27.80	
18456	H. U. Bean & Co., Philadelphia, Pa. Oat Feed	Frenchtown ...	5.77	3.19	5.50	1.46	3.00	31.53	30.00	
18024	Northern Illinois Cereal Co., Lockport, Ill. Reground Oat Feed (Mill Run)	Camden	7.37	3.60	5.50	1.26	3.00	29.84	30.00	
	Average	....	6.93	3.03	....	1.18	....	30.41	....	

REGROUND OAT HULLS

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed	Principal Ingredients Guaranteed
18198	J. J. Campbell, Hartford, Conn. Purity Reground Oat Hulls	Boonton	7.26	7.25	6.73	2.05	2.71	25.06	32.65	

RYE FEED

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed	Principal Ingredients Guaranteed
18470	W. F. Hummer, Mt. Pleasant, N. J. Rye Bran and Middlings	Mt. Pleasant ..	12.32	14.44	10.80	2.34	2.20	2.83	2.90	Rye bran and rye middlings.

WHEAT FEED

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed	Principal Ingredients Guaranteed
18687	Bay State Milling Co., Winona, Minn. Winona Fancy Mixed Wheat Feed and Wheat Screenings	Caldwell	9.88	16.19	16.00	5.03	4.50	5.98	8.00	Wheat bran, middlings and red dog flour with ground screenings from wheat.

	Duluth-Superior Milling Co., Duluth, Minn.								
18319	Boston Mixed Feed	Sussex	8.63	15.81	15.00	4.35	4.25	8.33	9.75 Wheat bran, middlings and low grade flour with ground screenings not exceeding mill run.
	J. A. Howell, Middletown, N. Y.								
18306	Hamilton Mixed Feed	ussex	9.32	16.00	16.00	4.44	3.75	7.73	8.50 Wheat bran and wheat middlings. Wheat bran with screenings not exceeding mill run.
	Kemper Mill & Elevator Co., Kansas City, Mo.								
18428	Crescent Mixed Feed with ground screenings not exceeding mill run	Blairstown	8.41	17.69	16.00	4.72	4.00	7.41	10.00
	National Feed Co., St. Louis, Mo.								
18308	Wheat Bran and Middlings run together with screenings not exceeding mill run	Sussex	8.92	14.38	15.00	3.64	4.00	9.26	9.00
	Pillsbury Flour Mills Co., Minneapolis, Minn.								
18318	Pillsbury Fancy Wheat Mixed Feed with ground screenings not exceeding mill run	Sussex	8.54	17.06	14.00	5.14	4.00	6.96	10.00
	Average	....	8.95	16.19	....	4.55	....	7.61	....

WHEAT AND RYE MIDDLINGS

	Mauser Mill Co., Treichlers, Pa.								
18359	Wheat and Rye Middlings	Pottersville	10.37	17.13	12.00	4.69	4.00	5.35	10.00
18519	Wheat and Rye Red Middlings	Lebanon	10.83	17.38	12.00	4.64	3.00	7.11	10.00
	Average	....	10.60	17.26	....	4.67	....	6.23	....

BADGER FANCY MIDDLINGS

	Chas. A. Krause M'l'g Co., Milwaukee, Wis.								
18296	Badger Fancy Middlings	Branchville	7.30	13.50	12.00	7.72	4.50	3.63	7.00 Maizo red dog flour and wheat middlings with ground screenings not exceeding mill run.

FEED MIXTURES

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed	Principal Ingredients Guaranteed
	Alfocorn Milling Co., East St. Louis, Ill.									
18887	Leader Horse and Mule Feed	Burlington	15.34	11.32	8.00	1.39	1.50	12.88	15.00	Corn, oats, alfalfa meal, molasses and salt.
	American Milling Co., Peoria, Ill.									
18020	Sucrene Horse Feed with Alfalfa	Camden	10.29	10.31	10.00	3.73	2.50	10.71	12.00	Molasses, alfalfa, corn, oats, barley, distillers' corn solubles and salt.
18562	Sucrene Horse Feed with Alfalfa	Trenton	8.84	12.25	10.00	3.79	2.50	11.98	12.00	Same as sample 18020.
18150	Amco Stock Feed	Paterson	8.15	16.13	10.00	6.77	3.50	9.44	9.00	Corn germ meal, corn feed meal, cottonseed meal, corn gluten feed, oat middlings, oat shorts, oat hulls and salt.
18454	Sucrene Dairy Feed	Frenchtown ...	8.18	19.19	16.50	4.76	3.50	14.25	14.00	Molasses, cottonseed meal, corn gluten feed, ground and bolted grain screenings, clipped oat by-product, corn distillers' dried grains and solubles, and salt.
18563	Sucrene Dairy Feed	Trenton	7.55	25.50	16.50	6.17	3.50	11.49	14.00	Same as sample 18454.
18851	Peoria Horse Feed	Allentown	10.05	11.13	11.00	3.47	2.50	12.68	14.00	Molasses, oat middlings, oat shorts, oat hulls, alfalfa meal, corn, oats, corn distillers' dried grains and solubles, and salt.
18871	Tip Top Horse Feed with Alfalfa	Bordentown ...	13.20	10.68	10.00	4.16	2.50	9.55	12.00	Molasses, alfalfa meal, oats, corn distillers' dried grains and solubles, and salt.
18937	Amco Fat Maker	New Egypt	9.97	11.00	10.00	4.70	3.50	10.82	12.00	Molasses, clipped oat by-product, corn, oats, corn distillers' dried grains and solubles, and salt.
18979	Amco Fat Maker	Alloway	9.77	10.94	10.00	4.01	3.50	9.86	12.00	Same as sample 18937.
18939	Tip Top Sugared Feed	Vincentown ...	9.13	17.19	12.00	4.64	2.50	15.15	14.00	Ground and bolted grain screenings, molasses, clipped oat by-product, cottonseed meal, corn distillers' dried grains and solubles, palm kernel meal and salt.
	Arcady Farms Milling Co., Chicago, Ill.									
18802	Arcady R K D Dairy Feed	Plainsboro	9.14	17.69	16.00	3.50	3.50	14.91	15.00	Malt sprouts, dried brewers' grains, cottonseed meal, molasses, ground and bolted clipped oat by-product, cleaned, ground and bolted grain screenings, salt and corn gluten feed.

18245	Arcady R K D Dairy Feed	Andover	11.37	16.56	16.00	4.40	3.50	15.49	15.00	Same as sample 18002.
	Baltimore Pearl Hominy Co., Baltimore, Md.									
18831	Spring Garden Brand Dairy Feed	Long Branch	7.24	18.63	20.00	6.83	5.00	7.83	11.00	Hominy feed, corn oil meal, cottonseed meal, flaked oats, dried brwers' grains.
	Blatchford's Calf Meal Factory, Waukegan, Ill.									
18228	Blatchford's Milk Mash	Morristown	9.05	20.44	20.00	4.95	4.00	5.87	7.50	Locust bean meal, unpressed flaxseed, wheat flour, barley and malt sprout meal, blood flour, ground beans and peas, rice polish, old process oil meal, cocoa shell meal, cocoanut meal, recleaned cottonseed meal, foenugreek, dried milk, anise, salt, bone, corn and oat meals, wheat middlings, meat scrap, fish and powdered limestone.
18229	Blatchford's Dairy Meal with Alfalfa	Morristown	8.94	17.69	17.50	5.78	5.00	14.21	18.00	Rice polish, blood flour, bran, ground oats, cocoa shell meal, wheat flour, bean meal, alfalfa meal and ½ of 1% salt.
18230	Blatchford's Pig Meal	Morristown	9.73	20.92	18.00	5.18	5.00	5.75	7.00	Linseed oil meal, locust bean meal, oat meal, blood flour, wheat flour, barley and malt sprout meal, recleaned cottonseed meal, crushed flaxseed, rice polish, corn meal, cocoa shell meal, anise and salt.
	Buffalo Cereal Co., Buffalo, N. Y.									
18109	Bufceco Horse Feed	Rutherford	8.93	11.94	11.00	5.19	4.00	9.65	9.00	Ground oats, corn, barley, wheat middlings, hominy feed, oat shorts, oat middlings, oat hulls, linseed oil meal and corn gluten feed.
18126	Bufceco Stock Feed	Paterson	8.08	10.19	10.00	4.77	5.00	11.57	10.00	Ground corn, oats, barley, wheat middlings, corn gluten feed, hominy feed, oat shorts, oat middlings, oat hulls and ½ of 1% salt.
18188	Bufceco Stock Feed	Passaic	7.72	11.50	10.00	5.64	5.00	11.18	10.00	Same as sample 18126.
18127	Bufceco Dairy Feed	Paterson	9.00	12.56	12.00	4.93	3.00	9.65	9.00	Ground corn, wheat bran, wheat middlings, hominy feed, corn gluten feed, oat shorts, oat middlings, oat hulls and ½ of 1% salt.
18677	Bufceco Chop Feed	Bloomfield	9.32	10.31	8.00	6.40	4.00	8.56	10.00	Ground corn, oats, barley, hominy feed, oat shorts and oat hulls.
	Chapin & Co., Chicago, Ill.									
18328	Unicorn Dairy Ration	Hamburg	8.90	27.31	26.00	5.61	5.50	9.65	11.00	Corn distillers' grains, cottonseed meal, linseed meal, hominy meal, corn gluten feed (cornstarch by-product with corn bran), barley feed, malt sprouts, brewers' grains, wheat bran and salt.
18570	Unicorn Dairy Ration	Trenton	6.38	29.13	26.00	6.44	5.50	8.08	11.00	Same as sample 18328.
18304	Lactola Dairy Feed	Sussex	11.19	18.81	16.50	4.68	3.00	6.72	12.00	Choice cottonseed meal, corn distillers' grains, clipped oat by-product, corn gluten feed, corn germ meal, brewers' grains, ivory nut meal, cane molasses and salt.

FEED MIXTURES—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed	Principal Ingredients Guaranteed
	Clover Leaf Milling Co., Buffalo, N. Y.									
18259	Clover Leaf Mills Dairy Feed	Newton	10.79	13.31	13.50	3.99	3.50	15.45	15.00	Corn distillers' dried grains, cottonseed meal, mixed broken grains consisting of wheat, corn, barley, flax speltz, ground grain screenings, cocoa shell meal, clipped oat by-product, molasses and ½ of 1% salt.
18886	Clover Leaf Mills Dairy Feed	Burlington	8.23	18.69	13.50	9.60	3.50	12.43	15.00	Same as sample 18259.
18292	Clover Leaf Mills Dairy Ration	Branchville	10.73	19.06	16.50	3.99	3.50	13.68	15.00	Corn distillers' dried grains, cottonseed meal, mixed broken grains consisting of wheat, corn, barley, flax speltz, ground grain screenings, cocoa shell meal, clipped oat by-product, molasses and ½ of 1% salt.
18984	Clover Leaf Mills Dairy Ration	Salem	10.60	16.81	16.50	3.93	3.50	13.24	15.00	Same as sample 18292.
18566	Clover Leaf Mills Dairy Ration	Trenton	8.07	18.19	16.50	5.61	3.50	13.09	15.00	Same as sample 18292.
18565	Peerless Horse Feed	Trenton	10.87	13.37	9.00	1.85	1.50	14.57	14.00	Cracked corn, whole oats, alfalfa meal, molasses and ½ of 1% salt.
	Corno Mills Co., St. Louis, Mo.									
18607	Corno Sweet Feed	Trenton	10.20	10.94	10.00	2.93	2.50	15.94	15.00	Whole oats crushed, ground choice alfalfa, cracked corn and molasses.
	Albert Dickinson Co., Chicago, Ill.									
18266	Hobby Horse Feed	Netcong	13.48	11.68	9.00	2.81	1.50	7.65	15.00	Corn, oats, alfalfa meal and molasses.
18595	Rival Horse Feed	Trenton	12.09	11.71	9.00	2.07	1.50	12.62	15.00	Corn, oats, alfalfa meal and molasses.
18840	Stag Stock Feed	Red Bank	10.86	11.13	9.00	3.56	3.00	4.84	12.00	Corn feed meal, ground corn bran, ground corn screenings, ground barley, oat meal mill by-product (oat middlings, oat hulls and oat shorts), wheat middlings, cottonseed meal and ½ of 1% salt.
	Economic Feed Co., New York City.									
18143	Economic Dairy Feed	Passaic	7.43	24.50	23.00	6.46	5.00	12.87	16.00	Dried distillers' and yeast grains from corn, rye, barley malt and sprouts, linseed meal, cottonseed meal, dried brewers' grains, wheat bran and salt.
18271	Economic Dairy Feed	Rockaway	6.19	24.81	23.00	6.16	5.00	13.70	16.00	Same as sample 18143.

18190	Creme De La Creme Horse and Dairy Feed	Passaic	10.92	21.38	15.00	5.30	5.00	11.50	15.00	Dried distillers' and yeast grains from corn, rye, barley malt and sprouts, linseed meal, cottonseed meal, dried brewers' grains from barley, wheat bran, molasses, humus and salt.
18260	Creme De La Creme Horse and Dairy Feed	Netcong	6.91	23.81	15.00	5.93	5.00	11.36	15.00	Same as sample 18190.
18261	Economic Horse and Dairy Feed with Molasses	Netcong	9.23	23.81	20.00	5.99	5.00	11.29	14.00	Dried distillers' and yeast grains from corn, rye, barley, malt and sprouts, linseed meal, cottonseed meal, dried brewers' grains from barley, wheat bran, humus and salt.
18351	Economic Horse and Dairy Feed with Molasses	Millington	8.26	21.44	20.00	4.60	5.00	11.27	14.00	Same as sample 18261.
18764	Economic Horse and Mule Feed	Plainfield	9.33	21.56	18.00	5.21	5.00	12.60	16.00	Dried distillers' and yeast grains from corn, rye, barley malt and sprouts, linseed meal, cottonseed meal, dried brewers' grains from barley, wheat bran, humus, molasses, corn and salt.
	John W. Eshelman, Lancaster, Pa.									
18513	Stock Feed	Titusville	8.77	9.63	10.00	3.84	3.00	11.03	9.00	Oat middlings, wheat middlings, cottonseed meal, ground grain screenings, rye middlings, corn meal, oat hulls and hominy feed.
180034	Stock Feed	Pitman	9.73	14.44	10.00	4.56	3.00	14.08	9.00	Same as sample 18513.
18801	Hamilton Horse Feed	Elizabeth	13.28	9.82	10.00	2.45	2.50	13.73	14.00	Crushed oats, cracked corn, alfalfa meal, molasses and ½ of 1% salt.
	Feed Products Milling Co., Chicago, Ill.									
18025	Kingfalfa Horse Feed	Camden	12.60	13.81	10.00	2.00	2.00	8.74	15.00	Alfalfa, molasses, cracked corn, oats and barley.
	Flory Milling Co., Bangor, Pa.									
18410	Special Mixed Horse Feed	Vail	12.70	12.44	8.00	4.20	4.00	3.80	5.00	Rye, oats, corn, wheat middlings and wheat screenings.
18411	Globe Cow Feed	Hope	9.50	19.00	20.00	5.04	5.00	6.22	10.00	Corn meal, wheat bran, wheat middlings, molasses, gluten feed, oil meal, cottonseed meal, alfalfa meal, brewers' grains and salt.
	Marshall M. Ford, Philadelphia, Pa.									
18026	Challenge Alfalfa Horse Feed	Camden	11.25	10.75	9.00	2.60	1.50	12.27	12.50	Cracked corn, oats, alfalfa meal, molasses and ½ of 1% salt.
	Globe Elevator Co., Buffalo, N. Y.									
18298	Anchor Brand Molasses Dairy Feed	Branchville	15.96	12.40	13.50	2.15	3.00	8.28	15.00	Cottonseed meal, corn gluten feed, linseed oil meal, malt sprouts, ground grain screenings, molasses and ¾ of 1% salt.
18473	Anchor Brand Molasses Dairy Feed	Belle Mead	11.31	11.94	13.50	2.57	3.00	10.25	15.00	Same as sample 18298.

FEED MIXTURES—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed	Principal Ingredients Guaranteed
	Globe Elevator Co., Buffalo, N. Y. (Cont.)									
18374	Globe Creamery Feed	Hackettstown	8.69	24.13	23.00	4.47	5.00	10.00	9.00	Corn distillers' dried grains, brewers' dried grains, beet pulp, cottonseed meal, linseed oil meal, clipped oat by-product, wheat bran and wheat middlings with ground screenings, corn gluten feed and ¾ of 1% salt.
18540	Globe Creamery Feed	Hopewell	9.50	26.44	23.00	4.18	5.00	8.51	9.00	Same as sample 18374.
18375	Buffalo Stock Feed	Hackettstown	8.74	12.00	10.00	4.78	4.00	9.29	12.00	Corn hominy feed, ground corn, ground oats, oat hulls, wheat middlings, cottonseed meal and ¾ of 1% celt.
18533	Blue Ribbon Horse Feed	Glen Moore	14.62	10.14	9.00	1.83	2.00	10.69	14.00	Cracked corn, oats, barley, shredded alfalfa, molasses and ¾ of 1% salt.
18539	Anchor Horse Feed	Hopewell	13.15	9.90	9.00	3.71	3.00	5.00	9.00	Cracked corn, crushed and ground oats, crushed barly, corn bran, molasses, wheat bran and ¾ of 1% salt.
18106	No. 1 Chop Feed	Fort Lee	9.31	10.38	8.00	5.69	4.00	9.69	12.00	Ground corn, corn hominy feed, ground oats, oat hulls, wheat middlings and ¾ of 1% salt.
18813	No. 1 Chop Feed	Freehold	9.29	10.63	8.00	5.98	4.00	7.36	12.00	Same as sample 18106.
	Golden Grain Milling Co., East St. Louis, Ill.									
18111	Mascot Horse and Mule Feed	Paterson	14.17	10.75	9.00	2.27	1.50	15.48	18.00	Corn, oats, alfalfa meal, molasses and ½ of 1% salt.
18800	Mascot Horse and Mule Feed	Elizabeth	13.49	11.01	9.00	1.77	1.50	15.68	18.00	Same as sample 18111.
18919	Golden Grain Mills Dairy Feed	Mt. Holly	9.32	13.00	12.00	4.07	3.00	15.88	18.00	Alfalfa meal, dried brewers' grains, oat clips, cottonseed meal, molasses and ½ of 1% salt.
	Grain Belt Mills Co., S. St. Joseph, Mo.									
18152	Oatfalfa Horse and Mule Feed	Paterson	14.49	11.42	12.00	2.10	2.00	17.02	17.00	Oats, alfalfa meal, molasses and ½ of 1% salt.
180047	Oatfalfa Horse and Mule Feed	Perth Amboy	13.49	13.12	12.00	2.09	2.00	14.38	17.00	Same as sample 18152.
18156	Greenleaf Alfalfa Molasses Feed	Paterson	15.53	11.21	10.00	0.77	0.75	18.12	26.00	Alfalfa meal, molasses and ½ of 1% salt.
18673	Greenleaf Alfalfa Molasses Feed	Newark	13.20	11.94	10.00	0.85	0.75	19.80	26.00	Same as sample 18156.

180005	Pennant Horse and Mule Feed	Swedesboro	16.59	11.44	10.00	1.19	1.00	11.98	18.00	Corn, oats, alfalfa meal, molasses and ½ of 1% salt.
	Hales & Edwards Co., Chicago, Ill.									
18587	Excelsior Horse Feed	Trenton	10.37	10.44	10.00	4.29	3.00	5.38	8.00	Rolled oats, sifted cracked corn and rolled barley.
18993	Harvest Horse Feed	Gloucester	14.83	11.63	10.00	1.65	2.00	12.34	15.00	Alfalfa, molasses, cracked corn, oats and barley.
18921	Harvest Horse Feed	Merchantville	7.14	13.75	10.00	2.11	2.00	12.15	15.00	Same as sample 18993.
18994	Gold Flake Dairy Feed	Gloucester	12.13	15.75	16.00	2.50	3.50	11.83	15.00	Cottonseed meal, corn gluten feed, linseed oil meal, molasses, clipped oat by-product, ground and bolted wheat, barley and Kaffir screenings and salt.
	The H-O Company, Buffalo, N. Y.									
18861	The H-O Co.'s Algrane Milk Feed	Red Bank	8.83	15.75	14.00	3.42	4.00	12.83	10.00	Oat hulls, wheat middlings, cottonseed meal, oat shorts, corn gluten feed, ground corn, crushed oats, ground grain screenings, molasses, clipped oat by-product and ½ of 1% salt.
	Indiana Milling Co., Terre Haute, Ind.									
18112	Holstein Feed	Paterson	9.27	10.06	12.00	3.14	3.00	17.98	16.00	Wheat bran with ground screenings not exceeding mill run and cob meal.
18240	Holstein Feed	Whippany	7.51	9.88	12.00	3.17	3.00	19.04	16.00	Same as sample 18112.
180040	Holstein Feed	Woodbridge	7.89	14.44	12.00	4.27	3.00	16.77	16.00	Same as sample 18112.
	International Sugar Feed Co., Minneapolis, Minn.									
18291	International Dairy Feed (Planters)	Branchville	8.18	23.63	22.00	4.00	3.50	19.36	18.50	Cottonseed meal, ground delinted cottonseed hulls, molasses and salt.
18330	International Climax Dairy Feed	Hamburg	11.58	13.69	12.50	6.13	4.00	14.44	14.00	Cottonseed meal, molasses, ground clipped oat by-product, salt and ground grain screenings.
	Kasco Mills, Waverly, N. Y.									
18202	Kasco Stock Feed	Westwood	10.74	13.00	11.00	4.95	3.00	4.71	8.00	Ground corn feed meal, hominy, flour middlings, oats, grain screenings, linseed oil meal and small percentage of salt.
	Chas. A. Krause Milling Co., Milwaukee, Wis.									
18287	Badger Fancy Mixed Feed	Branchville	8.89	12.75	12.00	8.99	4.00	4.35	9.00	Maizo red dog flour and wheat bran with ground screenings not exceeding mill run.
18189	Pul-mor Alfalfa Horse Feed	Passaic	16.36	11.13	9.00	1.21	1.00	13.57	16.00	Corn, oats, alfalfa, molasses, salt and clipped oat by-product.
18599	Pul-mor Alfalfa Horse Feed	Trenton	9.36	11.35	9.00	1.49	1.00	13.61	16.00	Same as sample 18189.
18193	Krause Dairy Feed	Boonton	8.69	24.25	24.00	5.56	5.00	9.68	10.00	Corn distillers' dried grains, brewers' dried grains, corn gluten feed, O. P. linseed oil meal, malt sprouts, cottonseed meal, corn germ meal, hominy feed, salt, wheat bran and wheat middlings with screenings not exceeding mill run.

FEED MIXTURES—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed	Principal Ingredients Guaranteed
	Chas A. Krause Milling Co., Milwaukee, Wis. (Cont.)									
18768	Krause Dairy Feed	Plainfield	7.05	25.38	4.00	5.38	5.00	11.71	10.00	Same as sample 18193.
18194	Krause Stock Feed	Boonton	8.11	11.38	10.00	8.84	4.50	6.49	12.00	Hominy feed, corn germ meal, Maizo red dog flour, oat meal mill by-product (oat middlings, oat hulls, oat shorts), and salt.
18195	Blue Top Horse Feed	Boonton	14.96	11.56	10.00	1.80	1.00	12.19	16.00	Corn, oats, alfalfa meal, molasses and salt.
18598	Blue Top Horse Feed	Trenton	9.33	12.31	10.00	1.66	1.00	15.12	16.00	Same as sample 18195.
18327	Badger Stock Feed	Sparta	8.39	10.25	10.00	6.13	4.50	10.10	12.00	Hominy feed, corn, corn germ meal, Maizo red dog flour, oat meal mill by-product (oat middlings, oat hulls, oat shorts).
18339	Badger Evergreen Feed	Hamburg	13.51	10.66	12.00	1.02	0.50	20.84	30.00	Alfalfa, molasses and salt.
18485	Badger Horse Feed	Lambertville	14.13	10.93	10.00	2.32	2.00	10.10	12.00	Corn, oats, alfalfa, molasses and salt.
18597	Crescent Horse Feed	Trenton	9.27	10.81	10.00	2.30	1.50	14.28	16.00	Corn, oats, alfalfa, molasses, salt and clipped oat by-product.
18884	Crescent Horse Feed	Florence	12.85	9.00	10.00	2.28	1.50	14.87	16.00	Same as sample 18597.
18635	Cream City Horse Feed	Yardville	13.26	9.68	10.00	2.16	1.50	15.39	14.00	Corn, oats, alfalfa meal, molasses and salt.
18869	Cream City Horse Feed	Bordentown	12.29	10.08	10.00	2.00	1.50	15.52	14.00	Same as sample 18635.
	Lancaster Mill & Elevator Co., Lancaster, Pa.									
18567	Conestoga Horse Feed	Trenton	12.69	11.05	10.00	3.56	2.50	12.32	14.00	Cracked corn, crushed oats, alfalfa hay meal, cane molasses and ½ of 1% salt.
18723	Conestoga Horse Feed	Hoboken	11.57	11.20	10.00	2.95	2.50	14.10	14.00	Same as sample 18567.
18568	Lancaster Horse Feed	Trenton	13.33	8.77	10.00	3.22	2.50	11.80	14.00	Alfalfa hay meal, cracked corn, rolled oats, salt and cane molasses.
18825	Lancaster Horse Feed	Englishtown	11.44	11.13	10.00	2.92	2.50	14.09	14.00	Same as sample 18568.
18609	Tally-Ho Horse Feed	Newark	12.63	7.85	7.00	3.37	2.00	14.64	16.00	Alfalfa, timothy and clover hay meal, cracked corn, rolled oats, cane molasses and salt.

	Larrowe Milling Co., Detroit, Mich.								
18040	Larro Feed	Camden	8.21	20.63	20.00	4.18	3.00	12.05	14.00	Cottonseed meal, corn gluten feed, dried distillers' grains mainly from corn, dried beet pulp, standard wheat bran and wheat middlings and ¾ of 1% salt. Wheat bran and wheat middlings may contain ground screenings not exceeding mill run.
18113	Larro Feed	Paterson	8.76	20.75	20.00	4.13	3.00	11.52	14.00	Same as sample 18040.
18645	Larrowe Big Six Complete Dairy Feed.	Newark	8.37	21.25	21.00	6.49	4.00	9.03	12.00	Linseed oil meal, cottonseed meal, corn gluten feed, distillers' dried grains mainly from corn, hominy feed, wheat bran, wheat middlings and ¾ of 1% salt. Wheat bran and wheat middlings may contain ground screenings not exceeding mill run.
	Metropolitan Mills, New York City.								
18082	Horse Power Feed	Hackensack	12.96	7.81	8.00	2.58	2.00	22.42	25.00	Cracked corn, oats, pure alfalfa meal, sugar cane molasses, palmo meal (peanut meats and hulls and palmoil), and ½ of 1% salt.
18730	Horse Power Feed	Hoboken	11.08	10.00	8.00	1.55	2.00	22.59	25.00	Same as sample 18082.
18097	Ivy Green Feed	Englewood	14.97	8.63	8.00	1.88	2.00	27.66	30.00	Pure alfalfa meal and sugar cane molasses.
18098	Comal Horse Feed	Homestead	15.14	9.56	8.00	3.00	2.00	15.64	15.00	Cracked corn, whole oats, alfalfa meal and sugar cane molasses.
18099	Alpha Grain Horse Feed	Palisades Park.	13.87	8.94	9.00	2.39	2.00	18.10	15.00	Whole oats, pure alfalfa meal, and sugar cane molasses.
18286	Allstock Molasses Grains	Dover	11.78	15.27	13.00	3.37	2.00	11.79	8.00	Pure dried brewers' grains and molasses.
18575	Arrowhead Horse Feed	Trenton	12.72	9.80	10.00	2.61	2.00	16.00	15.00	Pure alfalfa meal, whole oats and sugar cane molasses.
18721	Meadow Brook Horse Feed	Jersey City	16.81	8.81	8.00	2.65	2.00	17.60	20.00	Whole oats, pure alfalfa meal, sugar cane molasses, palmo meal (peanut meats and hulls and palm oil), and ½ of 1% salt.
18724	Monogram Feed	Hoboken	16.57	11.10	14.00	1.94	2.00	14.40	12.00	Pure alfalfa meal, oil meal, dried brewers' grains and sugar cane molasses.
	National Oats Co., St. Louis, Mo.								
18596	Pawnee Sweet Feed	Trenton	13.14	11.42	10.00	1.72	2.00	11.97	19.00	Choice ground alfalfa, cracked corn, oat feed and molasses.

FEED MIXTURES—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed	Principal Ingredients Guaranteed
	Nowak Milling Corporation, Buffalo, N. Y.									
18162	Fidelity Horse Feed	Paterson	13.62	11.29	7.00	2.82	3.00	14.06	14.00	Ground oats, corn feed meal, hominy feed, wheat middlings, oat middlings, clipped oat by-product, ground and bolted grain screenings and ¾ of 1% salt.
18163	Domino Creamery Feed	Paterson	8.86	21.25	22.00	5.38	4.00	14.08	12.00	Cocoanut oil meal, cottonseed meal, corn gluten feed, linseed oil meal, wheat middlings, corn distillers' dried grains, corn feed meal, clipped oat by-product, malt sprouts, brewers' dried grains, ground and bolted grain screenings and ¾ of 1% salt.
18878	Domino Creamery Feed	Columbus	8.57	23.69	22.00	5.05	4.00	12.30	12.00	Same as sample 18163.
18165	Domino Milk Maker Dairy Feed	Paterson	8.13	19.88	17.00	5.59	3.50	14.22	14.00	Cocoanut oil meal, cottonseed meal, malt sprouts, brewers' dried grains, clipped oat by-product, ground and bolted grain screenings and ¾ of 1% salt.
18166	Domino Horse Feed with Alfalfa	Paterson	9.08	7.56	9.00	2.26	2.00	12.20	12.00	Crushed oats, cracked corn, whole oats, ground alfalfa, molasses and ¾ of 1% salt.
18876	Domino Horse Feed with Alfalfa	Columbus	9.39	11.69	9.00	2.56	2.00	15.87	12.00	Same as sample 18166.
18337	Domino Butterine Dairy Feed	Hamburg	10.04	19.44	17.00	5.09	3.50	12.59	12.00	Cocoanut oil meal, cottonseed meal, malt sprouts, brewers' dried grains, clipped oat by-product, ground and bolted grain screenings, molasses and ¾ of 1% salt.
18891	Domino Butterine Dairy Feed	Hightstown	8.81	16.25	17.00	5.13	3.50	14.07	12.00	Same as sample 18337.
18918	Union Dairy Feed	Mt. Holly	11.25	11.56	10.00	3.79	2.00	13.86	14.00	Ground and bolted grain screenings, clipped oat by-product, linseed oil meal, wheat bran, molasses and ¾ of 1% salt.
	Omaha Alfalfa Milling Co., Omaha, Neb.									
18069	Peerless Alfalmo Horse Feed	Hackensack	11.82	12.69	10.00	1.37	2.00	15.00	12.00	Corn, oats, alfalfa meal and molasses.
18715	Peerless Alfalmo Horse Feed	Newark	8.50	13.19	10.00	1.54	2.00	16.54	12.00	Same as sample 18069.

18186	Omaha Special Horse Feed	Passaic	15.84	11.72	10.00	1.24	2.00	12.47	12.00	Corn, oats, alfalfa meal and molasses.
18678	Omaha Special Horse Feed	Bloomfield	11.86	12.50	10.00	1.28	2.00	14.77	12.00	Same as sample 18186.
18531	Green Meadow Dairy Feed	Pennington	14.59	12.06	11.00	0.73	1.00	17.75	25.00	Alfalfa meal and molasses.
18612	Green Meadow Dairy Feed	Newark	12.26	14.41	11.00	1.07	1.00	15.57	25.00	Same as sample 18531.
18716	Oat Peerless Horse Feed	Newark	14.04	12.33	10.00	1.80	2.00	13.51	12.00	Oats, alfalfa meal and molasses.
18763	Oat Peerless Horse Feed	Plainfield	13.66	12.28	10.00	1.58	2.00	12.18	12.00	Same as sample 18716.
	Park & Pollard Co., Boston, Mass.									
18086	Stevens Dairy Ration	Englewood	8.36	23.31	24.00	6.01	5.00	9.95	14.00	Oil meal, hominy meal, cottonseed meal, buckwheat middlings, wheat bran with mill run of screenings, corn gluten feed, corn meal, brewers' grains, cocoanut oil meal, pea meal, corn germ meal, corn distillers' grains, ground barley, wheat middlings and salt.
18499	Stevens Dairy Ration	Flemington	7.53	25.75	24.00	6.03	5.00	11.27	14.00	Same as sample 18086.
18169	Park & Pollard Co.'s Stock Feed	Paterson	9.11	10.38	9.00	5.25	1.50	11.32	12.00	Ground corn, hominy feed and oat feed.
	M. C. Peters Mill Co., Omaha, Neb.									
18050	Peters' Arab Horse Feed	Camden	11.21	12.31	10.00	2.52	2.00	9.97	15.00	Corn, oats, alfalfa and molasses.
18555	Peters' Arab Horse Feed	Trenton	11.22	11.41	10.00	2.52	2.00	12.50	15.00	Same as sample 18050.
18234	Peters' King Corn	Morristown	15.06	11.99	10.00	1.40	1.00	14.28	16.00	Corn, oats, alfalfa and molasses.
18999	Peters' King Corn	Camden	13.68	11.83	10.00	1.47	1.50	15.22	15.00	Same as sample 18234.
18273	Peters' Economy Horse Feed	Rockaway	12.68	13.42	10.00	3.00	2.00	13.95	20.00	Oats, alfalfa and molasses.
18720	Peters' Economy Horse Feed	W. Hoboken	8.58	14.44	10.00	3.06	2.00	14.20	20.00	Same as sample 18273.
18556	Peters' Rabbit Mule Feed	Trenton	13.25	12.11	10.00	1.87	1.50	13.26	18.00	Corn, oats, alfalfa and molasses.
18643	Peters' June Pasture	Newark	14.62	11.95	10.00	0.91	0.50	18.28	26.00	Pure alfalfa meal with molasses.
18681	Peters' June Pasture	W. Orange	9.94	12.00	10.00	1.18	0.50	19.17	26.00	Same as sample 18643.
	Phelps & Sibley Co., Cuba, N. Y.									
18102	Yellow P & S Feed	Homestead	10.66	8.88	7.00	2.56	3.00	7.51	9.00	Corn meal, corn feed meal and oat hulls.
18114	White P & S Feed	Paterson	10.44	10.00	7.00	5.81	3.00	5.77	8.00	Ground white corn, hominy feed and oat hulls.
	Prairie State Milling Co., Chicago, Ill.									
18584	Emerald Horse Feed	Trenton	12.71	10.25	10.00	1.75	2.00	13.49	12.00	Cracked corn, oats, barley, alfalfa meal and molasses.
18619	Emerald Horse Feed	Newark	9.96	12.94	10.00	1.94	2.00	11.48	12.00	Same as sample 18584.
	Purity Oats Co., Davenport, Iowa.									
18406	Scattergood Stock Feed	Vail	9.05	10.88	10.00	5.61	4.00	10.00	9.00	Wheat middlings, corn meal, hominy feed, brewers' dried grains, oat meal mill by-product (oat shorts, oat hulls, oat middlings), and 1% salt.

FEED MIXTURES—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed	Principal Ingredients Guaranteed
	Purity Oats Co., Davenport, Iowa (Cont.)									
18617	Iowa Stock Feed	Newark	8.31	11.19	10.00	5.64	4.00	12.57	12.75	Wheat middlings, corn meal, hominy feed, brewers' dried grains, oat meal mill by-product (oat shorts, oat hulls, oat middlings), and 1% table salt.
18765	Iowa Stock Feed	Plainfield	7.52	10.44	10.00	4.36	4.00	9.40	12.75	Same as sample 18617.
	Quaker Oats Co., Chicago, Ill.									
18131	Victor Feed	Paterson	8.58	10.69	9.00	5.76	3.00	9.26	12.00	Ground corn, hominy feed, corn feed meal by-product from manufacture of hominy and corn meal by the degerminating process with partial extraction of oil, oat meal mill by-product (oat middlings, oat hulls, oat shorts), and ½ of 1% salt.
18136	Green Cross Horse Mixed Feed with Molasses	Paterson	13.17	10.25	10.00	2.21	2.50	11.64	12.00	Alfalfa meal, ground corn crushed oats, molasses, cottonseed meal, oat meal mill by-product (oat middlings, oat hulls, oat shorts), and ½ of 1% salt.
18349	Green Cross Horse Mixed Feed with Molasses	Bernardsville	9.02	10.38	10.00	2.70	2.50	11.31	12.00	Same as sample 18136.
18149	Big "Q" Dairy Ration	Paterson	10.01	23.56	21.00	5.76	6.00	10.10	10.50	Cottonseed meal, corn distillers' grains and solubles, corn gluten feed, linseed oil meal, by-product from manufacture of hominy and corn meal by degerminating process with partial extraction of oil, white middlings and wheat bran with ground screenings not exceeding mill run, oat meal mill by-product (oat middlings, oat hulls, oat shorts), and 1% salt.
18325	Big "Q" Dairy Ration	Allamuchy	9.43	22.31	21.00	5.44	6.00	9.78	10.50	Same as sample 18149.

18157	**Schumacher Feed**	Paterson	9.48	12.88	10.00	4.60	3.25	8.44	10.00	Ground corn, hominy feed, corn feed meal by-product from manufacture of hominy and corn meal by degerminating process with partial extraction of oil, ground barley, wheat flour, wheat middlings with ground screening not exceeding mill run, cottonseed meal, ground puffed rice, ground puffed wheat, oat meal mill by-product (oat middlings, oat hulls, oat shorts), and ½ of 1% salt.
18350	Schumacher Feed	Millington	8.11	12.13	10.00	4.72	3.25	10.77	10.00	Same as sample 18157.
18388	Quaker Dairy Feed with Molasses	Hamburg	9.61	15.56	16.00	4.84	5.50	14.69	16.00	Molasses, corn distillers' grains, cottonseed meal, ground grain screenings, oat meal mill by-product (oat middlings, oat hulls, oat shorts), and ½ of 1% salt.
18747	Quaker Dairy Feed with Molasses	Somerville	8.44	14.88	16.00	6.09	5.50	15.16	16.00	Same as sample 18338.
18305	Buckeye Feed	Sussex	9.14	16.38	15.50	5.05	4.50	7.93	8.50	Wheat mixed feed with ground screenings not exceeding mill run, and rye shorts.
18534	Buckeye Feed	Hopewell	8.22	16.19	15.50	4.30	4.50	8.59	8.50	Same as sample 18305.
18904	Schumacher Special Horse Feed	Camden	8.05	11.13	9.25	4.20	3.25	6.20	9.00	Ground corn, crushed oats, oat meal mill by-product (oat middlings, oat hulls, oat shorts), and ½ of 1% salt.
180004	White Diamond Feed	Woodstown	8.72	8.75	8.00	5.99	3.25	9.02	9 00	Ground corn, hominy feed, corn feed meal by-product from manufacture of hominy and corn meal by degerminating process with partial extraction of oil, oat meal mill by-product (oat middlings, oat hulls, oat shorts), and ½ of 1% salt.
	Ralston-Purina Co., St. Louis, Mo.									
18324	Purina Cow Chow Feed	Allamuchy	10.26	25.63	24.00	3.77	4.75	14.17	13.50	Cottonseed meal, brewers' dried grains, gluten feed from corn, ground alfalfa, molasses and 1% salt.
18213	Purina Cow Chow Feed	Dumont	8.06	23.75	24.00	3.51	4.50	14.77	13.50	Same as sample 18324.
18486	Protena Dairy Feed	Lambertville	8.90	15.69	16.50	4.21	3.50	14.37	12.00	Cottonseed meal, brewers' dried grains, clipped oat by-product, ground wheat screenings, molasses and 1% salt.
18954	Protena Dairy Feed	Mt. Holly	9.03	15.06	16.50	3.14	3.50	13.76	12.00	Same as sample 18486.
18518	Purina Omolene Feed	Lebanon	13.12	9.86	9.70	4.59	3.20	7.31	8.00	Cracked corn, oats, molasses, ground alfalfa and 1% salt.
18642	Purina Dairy Feed	Newark	8.54	21.19	20.00	3.55	3.80	16.69	15.00	Cottonseed meal, brewers' dried grains, corn gluten feed, ground alfalfa, molasses and 1% salt.

FEED MIXTURES—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed	Principal Ingredients Guaranteed
	Ralston-Purina Co., St. Louis, Mo. (Cont.)									
18718	Protena Horse Feed	Jersey City	14.50	10.63	9.00	2.82	1.50	13.30	15.00	Cracked corn, oats, ground alfalfa, molasses and 1% salt.
18722	Protena Horse Feed	Jersey City	8.48	11.81	9.00	2.85	1.50	15.53	15.00	Same as sample 18718.
18877	Good Luck Dairy Feed	Columbus	10.27	12.50	13.50	2.07	3.50	7.49	13.00	Cottonseed meal, brewers' dried grains, clipped oat by-product, ground wheat screenings, molasses and 1% salt.
18983	Good Luck Dairy Feed	Alloway	8.78	12.31	13.50	3.65	3.50	14.29	13.00	Same as sample 18877.
18898	Purina Feed with Molasses	Cranbury	15.11	8.93	9.30	2.85	1.70	10.25	13.00	Ground corn, oats, ground alfalfa, molasses and 1% salt.
18978	Purina Sweet Feed	Quinton	12.08	11.94	8.00	1.17	1.00	21.17	20.00	Ground alfalfa, molasses and 1% salt.
18996	Purina Sweet Feed	Camden	14.65	10.66	8.00	0.85	1.00	20.21	20.00	Same as sample 18978.
18980	Good Luck Feed with Molasses	Alloway	9.89	11.19	8.00	2.53	1.50	14.69	15.00	Cracked corn, oats, ground alfalfa, molasses and 1% salt.
	The Shoemaker Co., Oakwood, N. Y.									
18187	Sh-O-Co. Horseshoe Brand Horse Feed	Ridgewood	16.01	9.83	8.00	1.82	2.00	16.22	15.00	Corn, oats, alfalfa meal, molasses and ½ of 1% salt.
	E. T. Shute & Co., Philadelphia, Pa.									
180003	Shute's Special Horse Feed	Woodstown	10.19	11.13	8.00	5.04	2.00	8.42	14.00	Oats, corn, alfalfa and molasses.
	The Sugarine Co., Peoria, Ill.									
18588	Ideal Sugared Feed	Trenton	9.90	14.25	12.00	3.43	2.50	13.08	14.00	Ground and bolted grain screenings, molasses, clipped oat by-product, cottonseed meal, corn distillers' dried grains, palm kernel meal and solubles and salt.
18834	Ideal Horse Feed with Alfalfa	Villa Park	10.66	11.56	10.00	4.75	2.50	12.40	12.00	Molasses, alfalfa meal, corn, oats, corn distillers' dried grains and solubles, and salt.
18986	Sugarine Dairy Feed	Salem	8.85	16.44	16.50	5.60	3.50	14.95	14.00	Molasses, cottonseed meal, corn gluten feed, ground and bolted grain screenings, clipped oat by-product, corn distillers' dried grains and solubles, and salt.

	Tioga Mill & Elevator Co., Waverly, N. Y.									
18336	Colonels Ration	Hamburg	9.27	14.56	12.00	3.78	2.50	10.19	15.00	Alfalfa meal, cane molasses, wheat middlings, corn feed meal, brewers' grains, wheat bran, linseed meal, hominy, small percentage of salt.
	Toledo Elevator, Indianapolis, Ind.									
18174	Star Feed	Passaic	8.88	8.63	7.00	6.53	5.50	12.34	12.50	Hominy feed, ground corncob and ½ of 1% salt.
18666	Star Feed	Newark	7.97	8.44	7.00	6.34	5.50	13.10	12.50	Same as sample 18174.
	Ubiko Milling Co., Cincinnati, Ohio.									
18248	Union Grains, Ubiko, Biles Ready Dairy Ration	Andover	7.72	25.06	24.00	7.15	7.00	9.89	10.00	Fourex distillers' dried grains, choice cottonseed meal, O. P. linseed meal, white wheat middlings, winter wheat bran, hominy meal, corn gluten feed, brewers' dried grains, barley, malt sprouts and ½ of 1% salt.
	Virginia Feed & Milling Corp., Alexandria, Va.									
18037	Tivoli Brand Sweet Feed	Camden	9.53	12.06	10.00	2.22	1.50	19.87	25.00	Alfalfa meal and molasses.
	Wash-Co. Alfalfa Milling Co., Fort Calhoun, Neb.									
18036	Alfalgreen	Camden	10.42	12.75	10.00	0.47	0.50	28.86	25.00	Alfalfa and molasses.
	Western Grain Products Co., Hammond, Ind.									
18321	Hammond Dairy Feed	Sussex	9.33	16.06	16.50	5.50	3.50	12.38	12.00	Cottonseed meal, corn distillers' grains, malt sprouts, ground clipped oat by-product, ground grain screenings, cocoa shell meal, molasses and salt.
18985	Hammond Dairy Feed	Salem	8.34	18.31	16.50	4.71	3.50	14.15	12.00	Same as sample 18321.
	F. C. Williams, Easton, Pa.									
18300	Tip Top Horse Feed	Branchville	8.63	11.13	10.00	4.95	3.30	3.96	5.50	Corn, rye middlings, oats and oat tailings.

FEED MIXTURES—New Jersey Manufacturers

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein		Fat		Fiber		Principal Ingredients Guaranteed
				Found	Guaranteed	Found	Guaranteed	Found	Guaranteed	
	Barker & Higgins, Bernardsville, N. J.									
18344	Barker's Feed	Bernardsville	10.25	10.50	8.00	3.62	3.00	3.05	7.00	Light oats or skimmings, corn and corn ears.
	Belvidere Flouring Mill Co., Belvidere, N. J.									
18397	Mixed Feed	Belvidere	11.15	10.00	8.00	2.62	2.40	5.28	20.00	Corn and cob meal, rye bran and middlings, and oats.
	Frank Bird, Flemington, N. J.									
18510	Hog Feed	Flemington	8.74	15.75	16.00	5.48	4.00	6.98	10.00	Corn meal, wheat bran, pea meal, buckwheat feed and buckwheat hulls.
	H. H. Blauvelt, Ridgewood, N. J.									
18180	Horse Feed	Ridgewood	11.99	9.88	9.81	4.46	4.54	2.29	2.64	Corn, oats and rye.
18184	Cow Feed	Ridgewood	10.95	17.25	16.81	4.93	4.47	5.35	4.63	Wheat middlings, wheat bran, corn meal, corn gluten feed, linseed meal and crushed oats.
	F. R. Boyd, Medford, N. J.									
18957	Boyd's Dairy Feed	Medford	10.35	16.94	12.00	4.94	3.00	10.90	12.00	Wheat bran and middlings, dried brewers' grains, corn ear meal, cocoanut meal, cottonseed feed, buckwheat feed, rye bran and middlings, corn gluten feed and "Good Luck Dairy Feed."
	Carpenter & Knight, Morristown, N. J.									
18226	Horse Feed	Morristown	10.81	11.50	9.00	5.48	3.25	5.00	4.00	Oats, corn, barley and screenings.
	Clinton Mills, Clinton, N. J.									
18547	Mixed Feed	Clinton	10.57	10.75	9.50	3.05	2.90	3.50	5.00	Corn, oats and rye bran.
	J. S. Collins & Son, Inc., Moorestown, N. J.									
18925	Horse Feed	Moorestown	13.00	11.94	10.00	4.11	4.00	8.12	4.00	Cracked corn, wheat bran, corn bran, oats and alfalfa.
18927	Dairy Feed	Moorestown	10.59	24.50	17.00	5.81	4.00	8.41	5.00	Corn bran, corn gluten feed, cottonseed meal, corn meal and wheat bran.
	Thos. Craig, Buttzville, N. J.									
18430	Horse Feed	Buttzville	10.41	8.88	8.00	3.42	2.00	5.88	8.00	Ear corn meal, oats and rye.
	C. H. Crisman, Branchville, N. J.									
18301	Rye, Oats, Corn and Barley	Branchville	10.40	11.75	10.00	3.74	3.00	5.24	5.00	Rye, corn, oats and rye middlings.
	Curtis & Laire, Everittstown, N. J.									
18462	Mixed Feed	Everittstown	10.68	9.94	9.25	4.44	3.65	3.35	2.50	Rye, corn and oats.

	A. Cyphers Co., Newark, N. J.									
18709	Cypho Dairy Feed	Newark	8.65	17.81	18.00	5.62	4.00	10.95	10.00	Corn gluten feed, linseed meal, buckwheat middlings with hulls, cocoanut oil meal, cottonseed meal, ground corn bran and ½ of 1% salt.
18702	Cypho Horse Feed	Newark	9.54	10.63	10.00	4.43	4.00	5.10	8.00	Ground corn, ground oat hulls, ground corn bran, linseed meal and salt.
	C. C. Dempsey & Co., Gloucester, N. J.									
18995	West Jersey Mixed Cow Feed	Gloucester	9.61	20.06	18.00	4.14	4.00	8.07	8.00	Corn gluten feed, dried brewers' grains, wheat middlings, wheat bran, buckwheat middlings and salt.
	Fairfield Dairy Supply Co., Little Falls, N. J.									
18219	A Dairy Feed	Little Falls	9.98	19.63	18.00	6.33	5.50	9.14	11.00	Wheat bran, dried distillers' grains mostly from corn, hominy feed, linseed oil meal, ground oats and salt. Wheat bran may contain mill run of screenings.
	Geo. W. Fisher, Port Murray, N. J.									
18382	Fisher's Mixed Feed	Port Murray	10.81	9.81	7.90	3.53	2.50	6.44	7.00	Corn, cob meal, rye feed, rye and oats.
	Flemington Milling Co., Flemington, N. J.									
18505	Mixed Feed	Flemington	10.90	10.88	8.75	2.82	2.90	4.13	5.49	Corn, oats and screenings.
	B. T. Haggerty, Glen Gardner, N. J.									
18544	Mixed Feed	Glen Gardner	13.38	8.69	7.00	3.48	2.00	6.17	7.00	Corn and cob meal, rye and oats.
	The Harrison Co., Caldwell, N. J.									
18692	Harrison Horse Feed	Caldwell	9.80	11.38	9.00	7.66	5.00	5.46	7.00	Oats, corn and hominy meal.
	Harrison Milling Co., Montclair, N. J.									
18696	Dairy Feed	Montclair	10.41	15.81	20.00	4.98	5.00	4.50	6.00	Gluten meal, wheat middlings, wheat bran, hominy feed, cottonseed meal, oil meal and red dog flour.
18699	Horse Feed	Montclair	9.68	11.63	9.00	5.43	5.00	3.73	7.00	Oats, corn, hominy meal, oat hulls and corn bran.
	Geo. C. Higgins & Son, Three Bridges, N. J.									
18490	Feed	Three Bridges	11.15	8.94	8.75	4.02	4.41	2.05	1.95	Corn, oats, wheat and rye.
	I. A. Hoffman & Son, German Valley, N. J.									
18377	Hoffman's King Feed	German Valley	13.43	8.94	8.50	3.50	3.05	7.28	8.00	Corn, cob meal, crushed oats and rye.
	Holley & Smith, Hackensack, N. J.									
18072	Ground Feed	Hackensack	11.12	10.38	7.00	3.94	3.00	3.87	4.65	Star feed or hominy chop, corn and oats.
	W. F. Hummer, Mt. Pleasant, N. J.									
18467	Mixed Feed	Mt. Pleasant	11.01	10.50	9.80	2.93	2.70	2.80	2.80	Ear corn, oats, rye, rye middlings, corn and hominy.
	W. I. Jacoby, Finesville, N. J.									
18441	Mixed Feed	Finesville	11.38	10.63	6.00	3.43	4.00	5.08	7.00	Corn and cob meal, oats, rye and rye middlings.
	I. B. Keener, Belvidere, N. J.									
18396	Horse Feed	Belvidere	11.17	11.50	8.00	3.59	2.00	6.74	10.00	Corn, oats and rye.

FEED MIXTURES—New Jersey Manufacturers—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed	Principal Ingredients Guaranteed
	Kirby Bros., Medford, N. J.									
18947	Mixed Dairy Feed	Medford	10.47	19.50	12.00	3.60	3.00	7.57	12.00	Brewers' dried grains, malt sprouts, corn and cob meal, corn gluten feed, ground rye screenings, wheat bran, cottonsesed meal, molasses dairy feed, buckwheat feed.
	Kuestner Bros., Trenton, N. J.									
18636	Alfalfa Grain Horse Feed	Trenton	9.17	11.75	10.00	5.00	3.50	7.49	10.00	Alfalfa, molasses, corn, oats and wheat bran.
18637	Sweet Cream Dairy Feed	Trenton	8.04	16.63	16.00	6.47	5.00	12.64	13.00	Cocoanut meal, peanut meal, cottonseed meal, alfalfa meal, molasses, corn, oats and wheat bran.
18640	All Grain Horse Feed	Trenton	9.43	11.75	10.00	5.18	4.00	4.87	8.00	Oats, corn and wheat bran.
	J. P. Larison, Washington, N. J.									
18433	Mixed Feed	Washington	11.28	9.06	9.00	3.53	3.50	7.08	10.00	Corn, corn ears, rye middlings, wheat and oats.
	G. G. MacPherson, Lebanon, N. J.									
18516	No. 2 Mixed Feed	Lebanon	10.74	9.81	8.75	3.65	3.00	5.82	6.50	Corn and cob meal, oats and rye.
	The Manning Co., Sussex, N. J.									
18302	Horse Feed	Sussex	10.12	12.19	10.00	4.58	3.50	3.70	3.90	Corn, oats and rye.
	McMurtrie Milling Co., Belvidere, N. J.									
18391	Horse Feed	Belvidere	16.33	10.50	8.00	2.80	2.00	5.10	8.00	Corn and cob meal, oats and rye.
	Neighbor & Son, Califon, N. J.									
18379	Horse Feed	Califon	10.25	9.25	8.00	3.61	3.00	6.05	6.14	Corn ears, oats and rye.
	Neu-Life Food Co., Burlington, N. J.									
18955	Neu-Life Dairy Food—Form No. 1	Burlington	8.74	17.25	20.00	6.12	8.00	22.20	18.00	Dried brewers' grains, corn gluten feed, peanut feed, wheat bran, soya bean meal, cocoanut meal and salt.
	Oradell Flour, Feed & Grain Co., Oradell, N. J.									
18207	Oradell Cow Feed	Oradell	10.41	13.81	12.82	4.38	5.50	6.18	4.50	Corn meal, wheat bran, wheat middlings and crushed oats.
	J. I. Pickens, Ridgefield, N. J.									
18091	Soft Feed	Ridgefield	10.02	13.31	13.00	4.45	4.00	7.80	8.00	Corn meal, wheat middlings, wheat bran, crushed oats, alfalfa meal and hominy feed.

18682	Est. of H. L. Pierson, Maplewood, N. J. Perfection Cow Feed	Maplewood	9.96	18.44	16.50	4.40	4.50	8.48	10.00	Alfalfa meal, wheat bran, wheat middlings, corn gluten meal, corn meal, cottonseed meal and oil meal.
18527	C. A. & T. P. Reed, Pennington, N. J. Alfalfa Dairy Feed	Pennington	8.24	21.69	20.60	3.83	4.34	11.60	15.00	Corn gluten feed, oil meal, wheat bran, corn and oats, dried brewers' grains, beet pulp, cottonseed meal and alfalfa meal.
18528	Alfalfa Horse Feed	Pennington	10.62	10.94	11.00	4.48	4.00	6.07	5.00	Whole oats, wheat bran, short cut alfalfa, cracked corn and molasses.
18523	W. H. Reger & Son, White House, N. J. Mixed Feed	White House	11.06	9.38	8.94	4.18	3.61	2.21	2.02	Corn and cob meal, oats and rye.
18275	The Geo. Richards Co., Dover, N. J. Richard's Dairy Feed	Dover	9.22	20.88	20.00	5.42	4.00	5.78	8.00	Wheat bran, corn meal, wheat middlings, cottonseed meal, wheat meal, O. P. oil meal, hominy feed and corn gluten feed.
18278	Richard's Horse Feed	Dover	9.97	11.81	11.00	4.45	4.00	4.22	6.50	Corn, oats, rye, barley and by-products from wheat and corn.
18279	Richard's Stock Feed	Dover	10.44	12.63	10.00	4.69	3.50	4.34	8.00	Oats, corn, rye, barley and hominy feed.
18798	J. M. Reuter & Co., Elizabeth, N. J. Ground Feed	Elizabeth	12.04	10.31	8.00	3.32	3.00	4.63	10.00	Corn, oats, oat hulls and barley.
18439	J. L. Riegel & Son, Riegelsville, N. J. Mixed Feed	Riegelsville	10.82	9.88	7.31	3.81	2.49	1.43	3.07	Rye, corn, oats, hominy and wheat middlings.
18615	C. Schaefer & Son, Townley, N. J. American Alfalfa Molasses Feed	Newark	15.29	9.29	9.00	0.71	1.00	14.85	25.00	Alfalfa and molasses.
18616	C. S. & S. Horse Feed	Newark	15.50	9.58	8.00	1.57	1.50	13.01	14.00	Alfalfa meal, corn, oats and sugar cane molasses.
18029	Sharpless & Bro., Camden, N. J. Knox-all Dairy Feed	Camden	9.78	9.94	10.00	2.78	2.00	9.24	15.00	Corn meal, alfalfa, molasses, salt, oat hulls, corn bran and 5% mill sweepings.
18031	Royal Molasses Horse Feed	Camden	10.67	11.25	8.00	2.78	2.00	12.60	15.00	Oats, alfalfa, molasses, salt and cracked corn.
18033	Royal Molasses Dairy Feed	Camden	9.40	21.56	14.00	3.93	3.00	10.40	15.00	Molasses, wheat bran, corn gluten feed, dried brewers' grains, salt, alfalfa, wheat middlings and cottonseed meal.
18906	No. 2 Dairy Feed	Haddonfield	7.21	10.19	9.50	2.84	2.00	12.22	15.00	Corn meal, corn bran, oat hulls, malt sprouts and 5% mill sweepings.
18432	S. A. Shillinger, Stewartsville, N. J. Horse Feed	Stewartsville	11.19	9.06	9.75	3.73	2.89	3.07	1.52	Corn, oats, rye and wheat.
18217	S. Sindle & Son, Little Falls, N. J. Ground Horse Feed	Little Falls	11.07	9.94	11.13	4.10	4.27	4.62	3.99	Rye, oats and corn.

FEED MIXTURES—New Jersey Manufacturers—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein		Fat		Fiber		Principal Ingredients Guaranteed
				Found	Guaranteed	Found	Guaranteed	Found	Guaranteed	
	Sitley & Son, Inc., Camden, N. J.									
18809	Peerless Alfalfa Horse Feed	Camden	11.65	9.94	9.00	2.85	1.00	9.90	16.00	Alfalfa, cracked corn, oats, syrup and salt.
18012	Cloverdale Alfalfa Horse Feed	Camden	11.27	10.75	8.00	4.45	2.00	6.68	15.00	Alfalfa, corn, oats and molasses.
18013	Peerless Alfalfa Cattle Feed	Camden	8.42	20.25	16.00	3.59	3.50	11.57	10.00	Alfalfa meal, dried brewers' grains, cottonseed meal, corn gluten feed, corn meal and molasses.
18992	Peerless Dairy Feed	Camden	15.45	8.69	9.00	4.57	4.00	3.94	10.00	Corn, oats and corn and oats screenings.
	Jos. Smith & Co., Stockton, N. J.									
18477	Mixed Feed	Stockton	11.56	9.50	7.00	4.02	3.00	**3.01**	**6.00**	Corn, oats, rye and corn bran.
	J. C. Smith & Wallace Co., Newark, N. J.									
18353	Prize Horse Feed	Murray Hill	15.05	10.44	10.00	2.61	2.00	10.26	12.00	Corn, alfalfa meal, oats, molasses and salt.
18354	Medal Horse Feed	Murray Hill	14.24	10.79	10.00	1.96	1.00	13.14	15.00	Corn, alfalfa meal, oats, molasses and salt.
18659	Prize Green Pasture	Newark	16.92	11.09	12.00	0.65	1.00	13.12	30.00	Alfalfa, molasses and salt.
18660	Prize Stock Feed	Newark	9.53	10.31	10.00	5.82	4.50	19.70	12.00	Hominy feed, barley, maizo corn oil meal, maizo red dog flour, oat meal mill by-product (oat middlings, oat hulls, oat shorts), and salt.
	Stamets & Pursel, Phillipsburg, N. J.									
18444	S & P Pure Mixed Feed	Phillipsburg	12.01	11.75	8.00	3.39	3.00	3.77	2.00	Rye, corn, oats and rye middlings.
	Z. V. Stillwell, Villa Park, N. J.									
18833	Corn and Oats	Villa Park	16.40	9.50	8.81	3.70	3.27	3.57	3.87	Corn and cob meal, ground oats, barley and rye.
	W. W. Supplee, Hampton, N. J.									
18423	Corn Ears, Oats and Rye	Hampton	10.49	8.06	8.50	3.23	3.00	6.35	5.15	Corn ears, oats and rye.
	Taylor Bros., Camden, N. J.									
18044	No. 2 Dairy Feed	Camden	9.76	12.19	11.00	4.41	2.50	10.25	8.00	Distillers' grains, flax screenings, buckwheat middlings, corn bran, oat screenings and elevator sweepings.
	W. & W. E. Thomas, Milford, N. J.									
18449	Mixed Feed	Milford	11.97	9.19	9.10	4.34	3.20	2.28	3.50	Corn, oats and wheat screenings.
	J. A. Tiger, Califon, N. J.									
18389	Horse Feed	Califon	11.25	10.69	7.00	3.94	2.00	5.42	2.50	Corn and cob meal, oats and rye.
	A. J. Van Den Berg, North Paterson, N. J.									
18167	No. 1 Corn, Oats and Rye Feed	No. Paterson	11.90	10.44	9.00	3.95	3.00	8.41	13.00	Corn, oats and rye.

	F. M. Van Ness, Towaco, N. J.									
18214	Mixed Feed	Towaco	9.84	11.25	10.00	6.34	4.00	4.13	8.00	Oats, corn meal, hominy meal and wheat middlings.
	E. J. Vusler, Hope, N. J.									
18402	No. 2 Horse Feed	Hope	10.98	11.25	9.50	3.37	2.25	3.62	6.00	Rye, oats and corn ears.
	Wilkinson, Gaddis & Co., Newark, N. J.									
18671	Ideal Corn and Oats Feed	Newark	10.52	10.75	10.14	4.46	2.36	4.89	8.00	Corn, oats and corn bran.
18676	Wilco Horse Feed Special	Newark	12.80	12.28	12.00	2.14	2.00	15.45	17.00	Oats, alfalfa meal, molasses and ½ of 1% salt.
	G. Z. Williams, Great Meadows, N. J.									
18425	Williams No. 2 Horse Feed	Great Meadows	10.52	10.25	7.00	3.33	3.00	6.66	12.00	Corn ears, oats and rye.
	J. S. Wiseburn & Son, Stephensburg, N. J.									
18371	Wiseburn's Horse Feed	Hackettstown	11.32	9.88	8.00	3.51	2.50	5.13	10.00	Ear corn, oats, rye and wheat middlings.
	D. R. Worman, Frenchtown, N. J.									
18457	Mixed Feed	Frenchtown	10.94	10.19	6.94	3.52	1.84	3.73	1.25	Rye screenings, corn and oats.
	Vernon Wortman, Pottersville, N. J.									
18362	Pure Feed	Pottersville	11.08	8.56	9.00	4.16	3.00	2.76	4.00	Corn, oats and rye.
18363	Mixed Feed	Pottersville	9.70	8.00	8.00	3.56	3.00	6.47	7.00	Corn and cob meal, oats and rye.
	J. R. Wyckoff, Princeton Junction, N. J.									
18572	Mercer Dairy Feed	Princeton Jct.	7.22	24.19	22.25	4.47	4.46	12.93	11.94	Corn gluten feed, oil meal, wheat bran, corn meal, dried beet pulp, dried brewers' grains, cottonseed meal and alfalfa meal.
	W. H. H. Wyckoff Co., Somerville, N. J.									
18760	Wyckoff's Stock Feed	Somerville	14.20	9.75	9.00	3.89	3.50	3.63	5.00	Ground corn, oats, barley, rye and wheat screenings.
18759	Wyckoff's Hog Feed	Somerville	9.04	12.44	9.44	3.71	2.25	5.33	5.00	Wheat, corn and rye screenings.
18761	Wyckoff's Horse Feed	Somerville	7.82	14.94	13.00	4.37	3.00	9.15	12.50	Ground oats, cracked corn, wheat bran, alfalfa, oil meal, dried brewers' grains, molasses and salt.
	Geo. O. Young, Andover, N. J.									
18247	Rye, Oats and Corn	Andover	13.56	9.19	10.00	3.38	4.00	2.85	7.00	Rye, oats and corn.

POULTRY FOODS

	American Milling Co., Peoria, Ill.									
18019	Tip Top Scratch Feed with Grit	Camden	9.84	10.94	10.00	3.40	2.50	3.07	5.00	Corn, wheat, wild buckwheat, oats, Kaffir corn, sunflower seed, barley and marble grit.
18159	Sucrene Scratch Feed—No Grit	Paterson	10.03	12.06	10.00	3.45	2.50	2.98	5.00	Corn, wheat, Kaffir corn, barley, sunflower seed, buckwheat and oats.
18814	Cluck-Cluck Scratch Feed—No Grit	Freehold	10.69	11.13	10.00	3.57	2.50	2.65	5.00	Corn, wheat, barley, Kaffir corn, sunflower seed and buckwheat.

POULTRY FOODS—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed	Principal Ingredients Guaranteed
	American Milling Co., Peoria, Ill. (Cont.)									
18850	Tip Top Scratch Feed—No Grit	Allentown	10.89	11.25	10.00	3.48	2.50	3.03	5.00	Corn, wheat, wild buckwheat, oats, Kaffir corn, sunflower seed and barley.
18933	Sucrene Chick Feed—No Grit	Moorestown	12.21	11.38	10.00	2.55	2.50	2.50	5.00	Corn, wheat, Kaffir corn and millet.
18934	Tip Top Chich Feed with 5% Grit	Moorestown	11.11	11.25	10.00	3.02	2.50	3.52	5.00	Corn, wheat, Kaffir corn, millet, pigeon grass and marble grit.
	Arcady Farms Milling Co., Chicago, Ill.									
18361	R. K. D. Poultry Feed	Pottersville	11.01	11.25	10.00	3.31	2.50	3.13	5.00	Wheat, cracked corn, Kaffir corn, barley, oats, buckwheat and sunflower seed.
	J. J. Badenoch Co., Chicago, Ill.									
18141	Daily Egg Poultry Feed—No Grit	Passaic	10.23	11.38	9.50	3.35	2.50	2.45	5.00	Wheat, cracked corn, Kaffir corn, barley, oats, sunflower seed and milo-maize.
18842	Daily Egg Poultry Feed—With Grit	Red Bank	9.61	11.38	9.50	3.15	2.50	3.19	5.00	Wheat, cracked corn, Kaffir corn, barley, oats, sunflower seed, milo-maize, grit and shell.
	Buffalo Cereal Co., Buffalo, N. Y.									
18117	Iroquois Chick Feed	Rutherford	10.62	10.63	10.00	2.30	2.00	1.71	3.00	Corn, wheat, Kaffir corn, peas and millet.
18125	Iroquois Scratching Grains	Paterson	11.43	11.44	10.00	3.12	3.00	2.12	5.00	Corn, oats, barley, buckwheat, Kaffir corn, wheat and sunflower seed.
18129	Bufceco Laying Mash	Paterson	9.04	20.50	20.00	6.26	5.00	7.31	6.00	Ground corn, oats, wheat, Kaffir corn, wheat bran, wheat middlings, linseed meal, alfalfa meal, oat middlings, meat and bone scrap and ½ of 1% salt.
18130	Bufceco Scratching Grains	Paterson	11.56	11.44	10.00	2.70	3.00	1.90	5.00	Corn, oats, barley, buckwheat, Kaffir corn, peas, sunflower seed and wheat.
18608	Bufceco Poultry Mash	Newark	9.56	16.31	15.00	5.14	4.00	5.57	6.00	Ground corn, wheat bran and middlings, hominy feed, corn gluten feed, oat middlings and rolled oats.
18731	Bufceco Pigeon Feed	Hoboken	11.20	12.63	10.00	2.91	3.00	1.77	4.00	Cracked corn, wheat, peas and Kaffir corn.
180036	Target Scratching Grains	Perth Amboy	11.95	10.00	10.00	3.88	3.00	2.48	5.00	Corn, oats, barley, wheat, Kaffir corn and buckwheat.
	Deposit Milling Co., Deposit, N. Y.									
18137	No. 2 Pure Grain Mixed Hen Feed	Paterson	11.86	10.94	10.00	3.11	2.50	2.06	4.00	Cracked corn, Kaffir corn, wheat, buckwheat, oats and sunflower seed.

18138	Pure Grain Mixed Poultry Feed	Paterson	11.74	10.00	10.00	3.37	2.50	2.04	4.00	Cracked corn, Kaffir corn, wheat, buckwheat and sunflower seed.
	Albert Dickinson Co., Chicago, Ill.									
18083	Globe Scratch Feed—No Grit	Hackensack	11.81	10.69	10.00	2.78	2.50	2.35	5.00	Corn, wheat, buckwheat, sunflower seed, barley, oats, Kaffir corn and oil cake.
18145	Rival Scratch Feed—No Grit	Passaic	12.17	10.88	9.50	2.63	2.50	2.50	5.00	Corn, wheat, barley, oats, Kaffir corn, wild buckwheat, recleaned grain screenings, with not to exceed 1% miscellaneous wild seeds occurring in the above seeds or grains.
18216	White Cross Scratch Feed—No Grit	Towaco	11.45	10.81	10.00	2.94	2.50	2.03	5.00	Corn, wheat, buckwheat, sunflower seed, barley, oats and Kaffir corn.
18265	Queen Poultry Mash	Netcong	10.43	12.06	11.00	5.04	2.50	4.54	10.00	Alfalfa meal, corn feed meal, wheat middlings, ground corn bran, wheat bran, meat scrap, linseed oil cake and ½ of 1% salt.
18797	Globe Egg Mash	Elizabeth	10.16	14.06	15.00	5.39	3.00	4.99	10.00	Wheat bran, wheat middlings, alfalfa meal, ground corn bran, corn feed meal, linseed oil meal, meat scrap and ½ of 1% salt.
	Ezl. Dunwoody Co., Philadelphia, Pa.									
18923	Special Poultry Mash Food	Moorestown	7.18	18.69	17.00	4.43	4.50	10.09	12.00	Wheat bran, wheat middlings, alfalfa meal, corn gluten feed, corn meal, beef scrap, bone meal and charcoal.
18924	Special Poultry Scratch Feed	Moorestown	11.84	11.25	10.00	3.63	3.00	3.26	4.50	Milo-maize, Kaffir corn, cracked corn, wheat, barley, oats, buckwheat and sunflower seed.
	R. D. Eaton Grain & Feed Co., Norwich, N. Y.									
18719	Eaton's Perfection Mash Mixture for Laying Fowls	West Hoboken	8.77	18.69	17.00	4.86	4.00	10.85	8.00	Alfalfa meal, milk albumen, milo-maize meal, beef scrap, charcoal, winter wheat bran, Kaffir corn meal, granulated bone, whole wheat flour, pea meal, linseed oil meal, corn gluten feed, bone flour, sodium chloride, ground oats and Heneta grits.
	John W. Eshelman, Lancaster, Pa.									
18210	Scratch Feed—No Grit	Dumont	12.28	10.56	10.00	3.02	3.00	1.63	3.00	Recleaned grain screenings from wheat, sunflower seed, wheat, barley, cracked corn, rye, oats, Kaffir corn and buckwheat.
18576	Laying Mash	Trenton	9.02	21.81	20.00	5.79	5.00	5.39	7.00	Gluten meal, cottonseed meal, oil cake meal, alfalfa meal, wheat bran, wheat middlings, corn meal, ground grain screenings, oat chop, hominy feed, beef and fish scrap.
18577	Pigeon Feed—No Grit	Trenton	12.21	12.38	10.00	2.58	3.00	2.36	3.00	Peas, millet, cracked corn, wheat, buckwheat, Kaffir corn, milo-maize and flaxseed.

POULTRY FOODS—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed	Principal Ingredients Guaranteed
	John W. Eshelman, Lancaster, Pa. (Cont.)									
18802	Scratch Feed—5% Grit	Elizabeth	11.05	8.56	10.00	2.85	3.00	2.56	3.00	Cracked corn, recleaned grain screenings from wheat, sunflower seed, wheat, barley, Kaffir corn, milo-maize, buckwheat, rye, oats and grit.
18830	Imperial Scratch Feed—No Grit	Long Branch	12.71	10.50	10.00	3.93	3.00	2.86	3.00	Cracked corn, corn, recleaned grain screenings from wheat, sunflower seed, wheat, barley, Kaffir corn, buckwheat, rye and oats.
180039	Imperial Scratch Feed—5% Grit	Woodbridge	13.28	9.31	10.00	3.04	3.00	2.57	3.00	Cracked corn, recleaned grain screenings from wheat, sunflower seed, wheat, barley, Kaffir corn, buckwheat, rye, oats and grit.
	Globe Elevator Co., Buffalo, N. Y.									
18154	Blue Ribbon Scratch Feed	Paterson	11.35	10.63	12.00	3.45	4.00	2.19	4.00	Cracked corn, wheat, barley, Kaffir corn, oats, buckwheat, sunflower seed and green split peas.
18231	Blue Ribbon Growing Mash	Morristown	9.38	19.50	16.00	5.65	3.00	5.84	5.00	Wheat bran, wheat middlings, corn meal, corn gluten meal, ground oats, meat meal and ground bone
18233	Star Scratching Grains	Morristown	10.69	10.56	11.00	2.62	3.00	2.22	6.00	Corn, cracked corn, Kaffir corn, wheat, barley, oats, buckwheat and peas.
18541	Blue Ribbon Laying Mash	Hopewell	9.50	17.19	20.00	4.37	3.00	7.85	10.00	Wheat bran, wheat middlings, wheat flour, ground oats, corn meal, corn gluten meal, pea meal, ground alfalfa, linseed oil meal, meat meal and ground bone.
18295	Anchor Scratch Feed	Branchville	10.32	10.88	12.00	3.22	4.00	2.35	5.00	Buckwheat, cracked corn, Kaffir corn, wheat, barley, oats and cracked peas.
18601	Blue Ribbon Pigeon Feed	Trenton	10.77	13.00	12.00	3.39	4.00	2.26	4.00	Corn, wheat, Kaffir corn, buckwheat, peas, millet and hemp.
18862	Blue Ribbon Little Chick Feed	Red Bank	11.05	12.25	12.00	4.60	3.00	2.69	3.00	Cracked wheat, cracked corn, millet, cracked Kaffir corn, cracked peas and oat meal.
	Hales & Edwards Co., Chicago, Ill.									
18585	Pound Squab Pigeon Feed with Grit	Trenton	11.25	10.19	10.00	3.37	2.50	2.04	5.00	Corn, wheat, Kaffir corn, peas, millet, hemp, buckwheat and not over 6% grit.

18586	Red Comb Poultry Feed—No Grit....	Trenton	11.75	10.56	10.00	3.18	2.50	2.52	5.00	Cracked corn, Kaffir corn, barley, oats, sunflower seed and buckwheat.
18870	Red Comb Meat Mash with Shell.....	Bordentown ...	9.44	15.19	15.00	2.83	4.00	6.04	10.00	Ground oats, linseed oil meal, corn feed meal, meat scrap, wheat bran, wheat middlings, alfalfa meal and not over 5% shell.
180010	Morning Glory Scratch Feed—No Grit	Hammonton ...	11.78	11.31	10.00	4.15	2.50	3.31	5.00	Wheat, cracked corn, Kaffir corn, barley, oats, wild buckwheat and sunflower seed.
	The H-O Company, Buffalo, N. Y.									
18618	The H-O Co.'s Poultry Feed	Newark	7.98	16.81	17.00	3.58	4.50	6.43	9.00	Ground corn, corn gluten feed, wheat middlings, oat middlings, wheat bran, hominy feed, rolled oats, ground peas, ground grain screenings and molasses.
	Chas. A. Krause Milling Co., Milwaukee, Wis.									
18192	Krause Scratch Feed—No Grit	Boonton	11.69	11.94	10.00	2.65	2.50	2.24	5.00	Wheat, corn, Kaffir corn, or milo-maize, barley, oats, buckwheat and sunflower seed.
18254	Blue Top Scratch Feed—No Grit.....	Newton	9.79	11.25	10.00	2.67	2.50	2.41	5.00	Corn, wheat, barley, oats, Kaffir corn, sunflower seed and buckwheat.
18484	Blue Top Scratch Feed with Grit.....	Lambertville ...	9.99	11.19	10.00	2.63	2.50	2.68	5.00	Corn, wheat, barley, oats, Kaffir corn, sunflower seed, buckwheat and grit.
18883	Cream City Scratch Feed—No Grit....	Florence	10.95	12.56	8.50	2.72	2.50	2.63	5.00	Cracked corn, wheat, barley, oats, Kaffir corn or milo-maize, buckwheat and sunflower seed.
	Nowak Milling Corporation, Buffalo, N. Y.									
18160	Domino Laying Mash	Paterson	8.28	19.94	20.00	5.49	3.00	6.96	10.00	Linseed oil meal, ground oats, wheat flour, wheat bran, wheat middlings, corn feed meal, corn gluten feed, alfalfa meal, ground bone and meat scrap.
18171	Marathon Scratch Feed	Paterson	10.65	11.25	10.00	3.46	3.00	2.87	5.00	Wheat, milo-maize, cracked corn, barley and buckwheat.
18246	Fidelity Scratch Feed	Andover	11.09	11.81	10.00	3.34	3.00	2.85	5.00	Cracked corn, whole wheat, milo-maize, barley, buckwheat and sunflower seed.
18172	Domino Scratch Feed	Paterson	11.31	10.75	10.00	2.90	3.00	2.63	5.00	Cracked corn, wheat, milo-maize, barley, buckwheat, sunflower seed and split green peas.
18549	Domino Developing Feed	Pennington	10.99	12.75	10.00	2.22	3.00	3.38	5.00	Cracked peas, buckwheat, milo-maize, wheat and cracked corn.
	Oswego Milling Co., Oswego, N. Y.									
18557	Pontiac Scratch Feed	Trenton	11.29	10.81	10.00	3.30	1.50	2.61	5.00	Cracked corn, wheat, barley, buckwheat, oats. Kaffir corn and milo-maize.
	Park & Pollard Co., Boston, Mass.									
18085	Lay or Bust (Dry Mash)	Englewood	9.20	23.13	18.00	4.64	1.50	5.45	12.00	Ground corn, wheat, oats, barley, Kaffir corn, buckwheat, alfalfa, fish, meat, bone, beet pulp, wheat bran with mill run screenings, wheat middlings, calcium carbonate and salt.
18087	Red Ribbon Scratch Feed	Englewood	11.48	11.19	10.00	3.16	1.50	2.29	5.00	Cracked corn, wheat, buckwheat, barley, oats, Kaffir corn, milo-maize and sunflower seed.

POULTRY FOODS—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein		Fat		Fiber		Principal Ingredients Guaranteed
				Found	Guaranteed	Found	Guaranteed	Found	Guaranteed	
	Park & Pollard Co., Boston, Mass. (Cont.)									
18191	Screened Scratch Feed	Ridgewood	10.22	11.42	10.00	2.83	1.50	2.26	5.00	Cracked corn, wheat, buckwheat, barley, oats, Kaffir corn, milo-maize and sunflower seed.
18647	Intermediate Chick Feed	Newark	11.05	11.25	10.00	3.25	1.50	1.62	5.00	Cracked corn, wheat, buckwheat, oats, millet seed, Kaffir corn and milo-maize.
18652	Growing Feed	Newark	9.29	13.19	10.00	1.99	1.50	3.76	8.00	Ground corn, wheat, barley, oats, meat, bone, alfalfa, Kaffir corn, wheat bran, wheat middlings, buckwheat, beet pulp, calcium carbonate and salt.
18932	Baby Buster Chick Feed	Moorestown	10.50	15.69	11.00	4.05	2.00	1.26	5.00	Cracked corn, wheat, Kaffir corn, milo-maize, millet seed, oats and shredded fish.
	Phelps & Sibley Co., Cuba, N. Y.									
18077	Favorite Pigeon Mixture	Hackensack	10.26	11.19	10.00	3.02	2.50	2.83	5.00	Cracked corn, wheat, Kaffir corn, milo-maize and buckwheat.
18104	Scratch Grains	Palisades Park	10.15	11.25	8.00	3.51	2.00	3.31	5.00	Cracked corn, Kaffir corn, buckwheat, oats, wheat and wheat screenings.
18105	Favorite Poultry Mash	Palisades Park	8.12	20.44	17.00	4.97	3.00	8.60	9.00	Linseed meal, beef scrap, alfalfa meal, corn gluten feed, ground oats, wheat middlings, corn meal, wheat bran, small quantity of charcoal and salt.
	Prairie State Milling Co., Chicago, Ill.									
180049	Red Crown Scratch Feed—No Grit	Woodbridge	11.67	10.94	10.00	4.10	2.50	2.63	5.00	Wheat, corn, oats, Kaffir corn, barley, sunflower seed, wild buckwheat, and not over 1% charcoal.
	Purity Oats Co., Davenport, Iowa.									
18021	Iowa Scratch Feed	Camden	10.47	12.31	10.00	3.89	3.25	2.86	5.00	Cracked corn, wheat, hulled oats, Kaffir corn or milo-maize, barley, recleaned wheat screenings, buckwheat and sunflower seed.
18161	Tom Boy Scratch Feed	Paterson	9.72	11.88	10.00	4.12	3.00	3.03	5.00	Cracked corn, wheat, hulled oats, Kaffir corn or milo-maize, barley, buckwheat and sunflower seed.
18767	Tom Boy Poultry Mash	Plainfield	8.05	17.50	15.00	5.73	4.00	4.99	10.00	Ground meat, wheat, oat meal, wheat middlings, milo-maize, buckwheat, corn meal, barley, oat middlings, millet, gluten feed, Kaffir corn, alfalfa meal, oat germ meal, hominy feed, wheat bran, rock phosphate, salt, calcium carbonate and charcoal.

	Quaker Oats Co., Chicago, Ill.									
18218	Pansy Scratch Grains	Mountain View	12.01	11.75	10.00	2.83	2.50	1.97	5.00	Whole wheat, Kaffir corn, milo-maize, barley, cracked Indian corn, buckwheat, ½ of 1% sunflower seed and oats.
18132	Schumacher Scratch Grains—No Grit..	Paterson	11.87	10.44	10.00	1.78	2.50	1.52	5.00	Whole Kaffir corn, milo-maize, wheat, barley, cracked Indian corn, buckwheat and ½ of 1% sunflower seed.
180051	Big Egg Scratch Grains	Woodbridge ...	11.20	12.00	10.00	3.73	2.50	3.51	5.00	Whole wheat, whole Kaffir corn, milo-maize, cracked Indian corn, sunflower seed, whole oats, whole barley and recleaned wheat screenings.
	Ralston-Purina Co., St. Louis, Mo.									
18211	Purina Chicken Chowder Feed with Charcoal not over 1%.	Little Falls	9.17	19.38	18.00	4.24	4.00	7.86	9.00	Wheat middlings, wheat bran, corn meal, not over 1% salt, alfalfa meal, granulated meat and charcoal.
18212	Purina Scratch Feed	Little Falls	11.36	10.63	10.00	3.39	2.50	1.91	4.00	Wheat, corn, barley, Kaffir corn or milo-maize, sunflower seed and buckwheat.
	The Sugarine Co., Peoria, Ill.									
18589	Ideal Scratch Feed with Grit	Trenton	10.47	11.19	10.00	3.53	2.50	3.66	5.00	Corn, wheat, wild buckwheat, Kaffir corn, oats, sunflower seed, barley and marble grit.
18835	Sugarine Scratch Feed—No Grit	Villa Park	10.66	10.69	10.00	3.57	2.50	3.33	5.00	Corn, wheat, barley, sunflower seed and buckwheat.
18903	Sugarine Poultry Mash	Chesterfield ...	8.69	18.00	18.00	4.01	3.50	7.59	12.00	Corn feed meal, alfalfa meal, meat scrap, corn distillers' dried grains, wheat bran, linseed meal and salt.
18987	Ideal Chick Feed	Salem	10.29	10.88	10.00	4.59	2.50	3.59	5.00	Corn, wheat, Kaffir corn, millet, pigeon grass and marble grit.
	Tioga Mill & Elevator Co., Waverly, N. Y.									
18334	Derby Scratch Feed	Hamburg	11.05	12.06	8.00	3.25	2.04	2.70	5.50	Cracked corn, wheat, buckwheat, Kaffir corn, oats, barley and sunflower seed.
	L. R. Wallace, Middletown, N. Y.									
18175	Mapes Balanced Ration for Poultry...	No. Paterson ..	9.57	15.00	12.00	3.73	4.00	5.01	8.00	Digester tankage, ground bone, corn meal, wheat middlings, wheat bran, corn gluten feed and ground oats.
	F. C. Williams, Easton, Pa.									
18270	Star Scratch Feed	Dover	10.70	11.19	9.00	2.59	2.50	2.49	3.50	Wheat, corn, barley, buckwheat, Kaffir corn and charcoal.
18751	Diamond Scratch Feed	Somerville	11.41	11.00	9.00	2.42	2.00	2.02	3.40	Wheat, corn, barley, buckwheat, Kaffir corn, charcoal and Heneta.
	J. M. Wyckoff, East Stroudsburg, Pa.									
18407	Scratch Grains	Hope	10.92	10.63	6.00	3.60	2.00	2.86	10.00	Cracked corn, wheat, oats, Kaffir corn, barley, sunflower seed and buckwheat.

POULTRY FOODS—New Jersey Manufacturers

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed	Principal Ingredients Guaranteed
	H. R. Applegate, Hightstown, N. J.									
18896	Jersey Dry Mash	Hightstown	10.16	23.88	19.38	5.42	5.06	7.13	12.63	Wheat bran and shorts, corn meal, corn gluten feed, alfalfa meal, ground oats and meat scrap.
	Frank Atherton Grain Co., Paterson, N. J.									
18122	Mixed Hen Feed	Paterson	11.83	10.31	12.00	2.82	3.00	1.99	5.00	Corn, wheat, barley and Kaffir corn.
18123	Poultry Laying Mash	Paterson	10.25	11.94	9.00	4.00	3.00	8.16	7.00	Corn meal, wheat bran and wheat middlings.
	Warren Beaty, Hackettstown, N. J.									
18415	Beaty's Scratch Feed	Hackettstown	11.69	10.75	7.00	3.86	3.00	2.34	5.00	Cracked corn, wheat, oats, buckwheat and Kaffir corn.
18417	Beaty's Mash Food	Hackettstown	10.45	12.75	10.00	4.39	3.00	4.37	10.00	Corn meal, alfalfa meal, buckwheat middlings, wheat bran and oats.
	B. M. Beideman, Merchantville, N. J.									
18920	Beideman's Mash Food	Merchantville	7.71	14.69	12.00	4.09	3.50	6.55	6.00	Corn meal, ground oats, wheat middlings, wheat bran, alfalfa and salt.
	G. B. Benedict, Elizabeth, N. J.									
18805	Mixed Chicken Feed	Elizabeth	11.39	9.94	9.94	2.54	3.50	1.81	2.25	Corn, wheat, cracked corn, barley, buckwheat, Kaffir corn, oats and trace of cockle.
	Frank Bird, Flemington, N. J.									
18508	Cereal Laying Feed	Flemington	9.00	17.88	16.00	5.01	5.00	3.29	8.00	Wheat bran, ground oats, corn meal, buckwheat cereal by-product, beef scrap, millet, buckwheat hulls and millet hulls.
18511	Scratch Feed No. 1	Flemington	10.31	10.44	9.00	3.76	3.00	2.19	4.00	Wheat, cracked corn, oats and buckwheat.
	F. R. Blamey, Bloomfield, N. J.									
18679	Blamey's Mash Feed	Bloomfield	9.87	16.75	14.00	5.46	5.00	7.83	10.00	Wheat middlings, wheat bran, corn meal, oil meal, alfalfa meal, ground oats and beef scrap.
18680	Blamey's Scratch Feed	Bloomfield	11.66	10.81	9.00	2.79	2.50	2.49	4.00	Cracked corn, Kaffir corn, wheat, buckwheat, sunflower seed and barley.
	H. H. Blauvelt, Ridgewood, N. J.									
18181	Poultry Feed—Dry Mash	Ridgewood	10.27	21.56	23.00	5.52	5.70	6.28	5.65	Wheat middlings, wheat bran, linseed meal, corn gluten feed, beef scrap, crushed oats, alfalfa meal and corn meal.
	Geo. Boggs & Son, West Collingswood, N. J.									
18910	Excelsior Dry Mash Feed	W. Collingswood	8.32	11.94	13.38	4.35	4.04	7.46	8.25	Wheat bran, wheat middlings, corn meal, corn gluten meal, ground oats and alfalfa meal.

18911	**Excelsion Scratching Feed**	W. Collingswood	9.28	10.81	8.50	3.93	4.17	2.69	3.75	Barley, cracked corn, sunflower seed, oats, wheat and buckwheat.
	Campbell, Morrell & Co., Passaic, N. J.									
18173	Eureka Chick Food	Passaic	11.07	11.75	10.00	3.64	2.00	2.88	2.39	Cracked corn, cracked wheat, millet, oat screenings and grit.
18177	Eureka Scratch Feed	Passaic	11.59	11.25	10.00	2.94	3.12	2.15	2.36	Cracked corn, buckwheat, wheat, Kaffir corn, sunflower seed and barley.
18179	Eureka Pigeon Food	Passaic	11.67	9.88	12.00	3.22	5.00	1.60	2.88	Wheat, buckwheat, cracked corn, hemp seed, millet, Kaffir corn and Canada peas.
18182	Eureka Poultry Mash	Passaic	10.40	15.25	12.00	4.14	3.00	3.70	6.01	Oil meal, wheat middlings, wheat bran, ground oats, alfalfa meal, corn meal, beef scrap and gluten meal.
	J. S. Collins & Son., Inc., Moorestown, N. J.									
18926	Rice's Mixture	Moorestown	8.97	19.81	18.00	5.64	5.00	5.89	5.00	Wheat bran, corn meal, wheat middlings, ground oats, linseed meal and ground meat.
18928	Pigeon Feed	Moorestown	11.57	15.88	12.00	6.26	4.00	4.20	4.00	Cracked corn, wheat, peas, hemp and millet.
18929	Scratch Feed	Moorestown	11.37	9.38	12.00	3.45	4.00	2.32	4.00	Cracked corn, Kaffir corn, wheat, barley, buckwheat and sunflower seed.
	Commercial Mills & Elevator, Plainfield, N. J.									
18771	C. M. & E. Mixed Grains	Plainfield	11.40	10.50	11.00	3.90	3.00	2.26	4.00	Corn, wheat, oats, cracked corn, buckwheat and sunflower seed.
	Consumers Coal Co., Plainfield, N. J.									
18782	Star Mixture	Plainfield	10.16	17.81	18.63	4.28	5.87	6.04	6.90	Corn meal, wheat bran, corn gluten feed, wheat middlings, ground oats, beef scrap, oil meal and alfalfa meal.
18783	Mixed Grains	Plainfield	10.91	9.88	8.69	2.68	2.33	2.16	2.30	Cracked corn, wheat, corn, oats, shell and buckwheat.
	Geo. Cox & Sons, West Hoboken, N. J.									
18733	Cox's Mixed Grains	W. Hoboken	11.80	10.19	9.75	3.79	3.29	1.96	1.60	Whole corn, cracked corn, buckwheat, Kaffir corn, red wheat, barley, sunflower seed, oats and Heneta bone grit.
	A. D. Crane, Elizabeth, N. J.									
18790	Crane's Mixed Grains	Elizabeth	11.63	9.69	8.00	3.66	3.00	2.58	5.00	Corn, cracked corn, wheat, buckwheat, barley, oats, sunflower seed, shell and grit.
18791	Crane's Mixed Grains — No Shell or Grit	Elizabeth	12.41	9.63	8.00	4.20	3.00	2.23	5.00	Corn, cracked corn, wheat, buckwheat, barley, oats and sunflower seed.
18792	Crane's Fine Mixed Grains	Elizabeth	11.21	10.06	8.00	3.95	3.00	3.17	5.00	Cracked corn, wheat, buckwheat, barley, oats, sunflower seed, shell and grit.
18793	Crane's Fine Mixed Grains—No Shell or Grit	Elizabeth	11.09	10.63	8.00	3.43	3.00	2.60	5.00	Cracked corn, wheat, buckwheat, barley, oats, Kaffir corn and sunflower seed.
18794	Affect Mixture	Elizabeth	9.62	16.13	12.00	4.68	3.00	5.38	7.00	Wheat bran, wheat middlings, ground oats, corn meal, beef scrap and oil meal.
18795	Soft Mash	Elizabeth	9.97	13.00	10.00	4.55	2.00	10.39	7.00	Corn meal, wheat middlings and wheat bran.

POULTRY FOODS—New Jersey Manufacturers—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed	Principal Ingredients Guaranteed
	W. A. Crowell & Son, Metuchen, N. J.									
180037	Mixed Grains	Metuchen	12.46	10.13	10.00	3.45	3.00	4.46	5.00	Cracked corn, wheat, oats and buckwheat.
180038	Dry Mash	Metuchen	8.53	20.06	16.00	5.43	4.00	9.26	10.00	Wheat middlings, corn meal, ground oats, beef scrap and alfalfa meal.
	A. Cyphers Co., Newark, N. J.									
18176	Cypho Scratching Food—A Grade	Ridgewood	11.82	10.38	10.00	2.91	2.50	1.84	3.00	Cracked corn, wheat, buckwheat, Kaffir corn or milo-maize, barley, sunflower seed and green peas.
18706	Cypho Morning Mash—A Grade	Newark	9.17	17.94	15.00	5.54	3.00	9.69	12.00	Corn meal, ground Kaffir corn, wheat middlings with mill run screenings, alfalfa meal, rolled oats, cottonseed meal, linseed meal, corn gluten meal, buckwheat middlings and buckwheat hulls, ground charcoal, meat and bone meal.
18707	Cypho Morning Mash—B Grade	Newark	9.92	17.19	15.00	6.06	3.00	7.59	12.00	Corn meal, ground Kaffir corn, wheat middlings with mill run screenings, alfalfa meal, rolled oats, cottonseed meal, linseed meal, buckwheat middlings and buckwheat hulls, ground charcoal and corn gluten meal.
18703	Cypho Scratching Grains—B Grade	Newark	10.28	9.75	10.00	2.68	2.00	1.97	3.00	Cracked corn, wheat, buckwheat, Kaffir corn or milo-maize, barley, wheat screenings, grit or oyster shell.
18705	Cypho Chick Food—A Grade	Newark	10.63	11.38	10.00	4.12	2.00	2.34	3.00	Cracked corn, cracked Kaffir corn, oat groats, cracked wheat, broken rice, millet seed and cracked green peas.
18708	Cypho Mixed Grains	Newark	10.79	10.63	10.00	2.63	2.00	1.94	3.00	Cracked corn, wheat, buckwheat, barley, Kaffir corn or milo-maize and sunflower seed.
	F. S. Eldridge, Cranbury, N. J.									
18897	Eldridge's Mash Food	Cranbury	9.83	21.69	6.50	5.10	3.00	9.93	9.00	Beef scrap, corn meal, wheat shorts, oil meal, corn gluten meal, ground oats, wheat bran, alfalfa meal, charcoal and salt.
	J. P. Golden & Son, Yardville, N. J.									
18634	Scratch Feed	Yardville	11.42	9.94	10.00	3.80	2.50	2.24	5.00	Cracked corn, wheat, oats, barley, buckwheat and sunflower seed.

	Gross Bros, Hightstown, N. J.									
18893	Poultry Dry Mash	Hightstown	9.17	20.88	16.56	4.86	4.20	10.56	10.45	Wheat bran and middlings, corn meal, alfalfa meal, beef scrap, charcoal, linseed oil meal, salt, cottonseed meal and ground oats.
	Hackensack Grain & Hay Co., Hackensack, N. J.									
18079	Henola Dry Mash	Hackensack	9.86	15.50	10.00	4.66	2.50	5.75	4.00	Corn meal, wheat middlings, wheat bran, oil meal and Heneta.
18080	Hackensack Scratch Feed	Hackensack	10.82	11.31	10.50	3.20	3.10	2.90	3.90	Wheat, cracked corn, barley, buckwheat and Kaffir corn.
18081	Laying Mash	Hackensack	9.49	17.31	13.32	4.87	4.20	7.48	9.49	Wheat bran, corn meal, wheat middlings, ground oats, oil meal, meat scrap and alfalfa meal.
	Reeve Harden, Hamburg, N. J.									
18340	Dry Mash	Hamburg	8.53	13.25	15.00	2.64	3.00	3.35	6.00	Corn meal, corn gluten feed, red dog flour, wheat bran, Heneta and oil meal.
	Harrison Milling Co., Montclair, N. J.									
18697	Star Scratch Feed	Montclair	13.66	9.38	9.00	3.27	2.50	1.39	4.00	Cracked corn, Kaffir corn, wheat, buckwheat, sunflower seed and barley.
18698	Chicken Mash	Montclair	10.76	14.50	15.00	4.58	5.00	4.63	9.00	Wheat middlings, wheat bran, corn meal, oil meal, alfalfa meal, beef scrap and charcoal.
	Hasselhuhn-Williams Co., Rutherford, N. J.									
18116	Balanced Ration	Rutherford	9.00	18.25	21.78	4.82	5.94	6.30	4.20	Wheat middlings, wheat bran, corn meal, alfalfa meal, beef scrap, corn gluten meal and oil meal.
	Alvin Hill & Son, Flemington, N. J.									
18501	Hill's Scratch Feed	Flemington	12.69	10.00	10.00	3.34	4.00	1.96	3.00	Cracked corn, wheat, oats and buckwheat.
	E. Hollingshead, Moorestown, N. J.									
18935	Rice's Mixture—Dry Mash	Moorestown	10.27	18.13	19.44	5.18	4.76	5.94	5.30	Wheat bran, corn meal, ground oats, ground meat and linseed cake meal.
18936	Our Own Scratch Feed	Moorestown	11.50	10.13	10.50	4.73	3.25	3.98	3.50	Cracked corn, wheat, oats, barley, milo-maize, sunflower seed, buckwheat and charcoal.
	Holley & Smith, Inc., Hackensack, N. J.									
18073	Mixed Grains	Hackensack	11.67	10.25	9.00	3.50	3.00	1.87	2.50	Corn, cracked corn, buckwheat, wheat and Kaffir corn or milo-maize.
18074	Dry Mash	Hackensack	10.16	17.13	12.00	4.30	3.00	5.28	10.00	Corn meal, hominy feed, wheat bran, wheat middlings, alfalfa meal and meat scrap.
	W. F. Hummer, Mt. Pleasant, N. J.									
18469	Hustler's Scratch Feed	Mt. Pleasant	11.72	10.69	10.20	2.91	2.80	3.01	2.40	Cracked corn, wheat, oats, Kaffir corn, barley, sunflower seed, buckwheat and grit.
	Hutchinson Bros., Crosswicks, N. J.									
18864	H. B. Scratch Feed	Crosswicks	12.27	9.69	10.88	4.25	3.58	2.34	2.83	Cracked corn, wheat, oats, buckwheat, Kaffir corn and sunflower seed.
	E. C. Hutchinson Milling Co., Trenton, N. J.									
18592	Hamilton Scratch Feed	Trenton	12.05	10.88	10.00	2.92	3.00	1.95	3.00	Cracked corn, recleaned grain screenings from wheat, sunflower seed, barley, wheat, Kaffir corn, buckwheat, rye and oats.
	W. I. Jacoby, Finesville, N. J.									
18442	Mixed Grains	Finesville	11.60	9.75	9.00	3.53	3.00	2.40	4.00	Cracked corn, wheat, oats and buckwheat.
	Johnson Bros., Bridgeton, N. J.									
18967	Scratch Feed	Bridgeton	12.69	9.25	10.00	4.72	3.00	2.75	5.00	Cracked corn, oats, chicken wheat and sunflower seed.

POULTRY FOODS—New Jersey Manufacturers—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed	Principal Ingredients Guaranteed
	Kuestner Bros., Trenton, N. J.									
18593	Golden Egg Poultry Scratch — Grade No. 1	Trenton	9.70	11.63	11.00	4.75	3.50	2.35	5.00	Barley, oats, cracked corn, wheat, sunflower seed and granulated milk albumen.
18638	Golden Egg Laying Mash — Extra Strong	Trenton	7.66	27.25	25.00	6.67	5.00	6.50	10.00	Cocoanut meal, peanut meal, ground millet, wheat bran, alfalfa meal, corn meal, gluten meal, ground oats, wheat middlings, mustard bran, dried blood meal, meat meal and dried fish.
18639	Golden Egg Laying Mash—Grade No. 1	Trenton	8.87	19.75	18.00	5.26	3.50	6.41	9.00	Wheat bran, corn meal, barley meal, gluten feed, corn bran, wheat middlings, alfalfa meal and meat meal.
	C. L. Lade, Morristown, N. J.									
18237	Lade's Poultry Mash	Morristown	11.09	14.25	17.60	4.88	5.00	6.00	6.30	Wheat middlings, wheat bran, corn meal, ground oats, oil meal and beef scrap.
	J. P. Larison, Washington, N. J.									
18431	Scratch Grains	Washington	11.79	9.38	9.50	4.28	3.00	2.02	4.00	Cracked corn, barley, oats, buckwheat, Kaffir corn, sunflower seed and wheat.
	C. H. Leonard Co., Boonton, N. J.									
18201	Poultry Mash	Boonton	10.07	18.81	18.50	5.18	4.00	5.46	8.00	Gluten feed, wheat bran, wheat middlings, beef scrap, corn meal and ground oats.
	Long Dock Mills, Jersey City, N. J.									
18734	Londome Scratch Feed	Jersey City	11.59	10.06	10.00	3.20	2.00	2.28	5.00	Corn, wheat, Kaffir corn, barley, oats, peas, buckwheat and sunflower seed.
18735	Florida Laying Mash	Jersey City	9.23	22.19	15.00	5.48	4.00	9.91	9.00	Alfalfa meal, corn bran, corn germ meal, wheat bran and wheat middlings with ground screenings not exceeding mill run, meat scrap, linseed oil meal and not over ½ of 1% salt.
	McMurtrie Milling Co., Belvidere, N. J.									
18394	Scratch Feed	Belvidere	12.16	10.50	10.00	3.39	3.00	2.06	7.00	Cracked corn, wheat, barley, oats, buckwheat, Kaffir corn and sunflower seed.
	Millville Flour & Grain Co., Millville, N. J.									
180032	Dry Mash	Millville	11.58	17.69	18.78	5.97	5.23	5.32	3.90	Wheat bran and middlings, ground oats, corn gluten feed, beef scrap, alfalfa meal, charcoal, salt and oil cake meal.
180033	Scratch Feed	Millville	13.25	10.19	10.50	3.57	3.58	2.59	2.73	Cracked corn, wheat screenings, oats, barley, buckwheat, Kaffir corn and sunflower seed.

	C. P. Mohrfeld, Collingswood, N. J.									
18908	Ideal Scratch Feed	Collingswood	11.86	10.44	8.50	3.20	2.50	2.24	4.00	Cracked corn, wheat, oats, barley, buckwheat, sunflower seed and sifted wheat screenings.
18909	Ideal Mash Feed	Collingswood	7.50	15.88	17.00	3.91	4.25	9.13	8.50	Wheat bran, wheat middlings, corn meal, ground oats, charcoal, alfalfa meal, gluten meal, fish, bone and linseed oil meal.
	Nischwitz & Son, Plainfield, N. J.									
18781	Nischwitz Mixed Grains	Plainfield	13.43	10.19	10.38	3.45	3.69	2.05	2.40	Corn, cracked corn, wheat, oats, buckwheat, Kaffir corn, barley, sunflower seed.
	J. F. Noll & Co., Newark, N. J.									
18620	Economy Brand Chick Food	Newark	9.84	11.00	10.00	3.95	3.50	2.22	3.00	Corn, Kaffir corn, wheat, oat meal, rape, millet and hemp seed.
18631	Economy Brand Scratch Food	Newark	11.26	11.44	10.50	2.70	2.56	1.76	4.00	Kaffir corn, corn, wheat, barley, buckwheat and sunflower seed.
	Oradell Flour, Feed & Grain Co., Oradell, N. J.									
18206	Oradell Hen Mash	Oradell	10.27	18.44	18.88	5.49	4.97	5.84	5.11	Corn meal, wheat bran, wheat middlings, gluten meal and meat scrap.
18208	Oradell Scratching Feed	Oradell	11.91	11.69	10.25	3.92	3.22	2.30	2.96	Wheat, cracked corn, barley, buckwheat, Kaffir corn, sunflower seed and 1% charcoal.
	J. I. Pickens, Ridgefield, N. J.									
18092	Chicken Feed	Ridgefield	11.34	10.00	9.00	3.55	4.00	1.98	3.00	Cracked corn, corn, buckwheat, Kaffir corn, wheat, oats and oyster shell.
	Est. of H. L. Pierson, Maplewood, N. J.									
18683	Laying Food	Maplewood	10.15	19.00	19.25	4.67	4.25	7.39	7.75	Wheat bran, corn meal, gluten meal, beef scrap, alfalfa meal, oil meal and wheat middlings.
18684	Scratch Food or Mixed Grains	Maplewood	12.08	10.63	10.50	3.41	3.00	2.72	4.50	Cracked corn, wheat, Kaffir corn, buckwheat, sunflower seed and oats or barley.
	W. H. Reger & Son, White House, N. J.									
18522	Scratch Feed	White House	12.41	9.56	10.44	3.46	2.77	1.99	1.93	Cracked corn, oats, wheat and buckwheat.
	The Geo. Richards Co., Dover, N. J.									
18276	Richards' Mixed Poultry Grains	Dover	12.21	11.38	10.25	3.09	3.10	4.28	4.00	Wheat, corn, barley, buckwheat, Kaffir corn, milo-maize, oats, hemp seed, sunflower seed and peas.
18277	Richards' Chick Grain	Dover	11.54	12.13	13.35	2.78	4.00	2.28	6.00	Cracked wheat, oat meal, millet seed, canary seed, hemp seed, cracked corn, beef scrap and charcoal.
	Rockhill & Fowler, Haddonfield, N. J.									
18905	R & F Mash Feed	Haddonfield	7.65	18.63	15.00	3.71	3.00	9.00	8.00	Ground corn bran, alfalfa, wheat middlings, ground oats, ground flaxseed, malt sprouts, corn gluten feed, charcoal and ground meat.
18907	R & F Scratch Feed	Haddonfield	8.53	11.69	10.00	4.44	3.00	4.25	6.00	Corn, oats, barley, wheat screenings, buckwheat and sunflower seed.
	Chas Schaefer & Son, Townley, N. J.									
18611	American Standard Scratch Feed	Newark	10.93	10.88	11.00	3.58	3.50	2.21	9.00	Wheat, oats, Kaffir corn, buckwheat, wheat screenings, cracked corn, milo-maize, hulled oats and cracked peas.

POULTRY FOODS—New Jersey Manufacturers—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed	Principal Ingredients Guaranteed
	Sharpless & Bro., Camden, N. J.									
18027	S & B Chick Feed	Camden	11.21	10.00	9.00	3.75	2.00	1.93	3.00	Millet, cracked wheat, grain screenings, cracked corn and Kaffir corn.
18032	Royal Chick Food	Camden	11.12	8.81	10.00	3.13	2.50	1.79	3.00	Millet, cracked wheat, Kaffir corn, rice and prepared corn.
18034	Royal Scratching Food	Camden	11.64	11.00	10.00	3.13	2.50	1.77	3.00	Wheat, millet, prepared corn, Kaffir corn, grain screenings, buckwheat, barley, oats and sunflower seed.
18035	Royal Mash Food	Camden	9.38	13.75	12.00	3.25	3.00	9.60	12.00	Cut alfalfa, ground oats, wheat middlings, gluten feed, corn meal and wheat bran.
	Sitley & Son, Inc., Camden, N. J.									
18007	Peerless Baby Chick Food	Camden	10.08	10.31	10.00	2.22	2.00	1.27	5.00	Corn, rice, wheat, Kaffir corn, millet and oats.
18010	S & S Chick Feed	Camden	10.23	10.00	8.00	2.45	2.00	1.66	5.00	Corn, wheat, Kaffir corn, millet, wheat screenings and oats.
18011	S & S Scratching Feed	Camden	9.93	9.75	8.00	2.56	3.00	1.85	5.00	Wheat, cracked corn, barley, oats, Kaffir corn, sunflower seed, grit and shell.
18014	Peerless Mash Feed	Camden	8.43	17.31	15.00	5.33	4.00	8.28	8.00	Oats, corn, salt, wheat middlings, wheat bran and animal meat.
18015	Peerless Pigeon Feed	Camden	10.30	13.13	10.00	4.33	3.00	3.17	5.00	Kaffir corn, millet, peas, hemp, corn, flaxseed, buckwheat, rice and wheat.
18016	Peerless Developing Feed	Camden	9.69	10.44	10.00	4.92	4.00	3.43	5.00	Hemp seed, wheat, Kaffir corn, corn, oats, barley and millet.
18017	Peerless Scratching Feed	Camden	10.58	9.94	10.00	4.13	3.00	2.20	5.00	Sunflower seed, barley, Kaffir corn, buckwheat, ground meat, millet, wheat and corn.
18991	Peerless Chick Feed	Camden	11.37	10.06	10.00	2.62	2.00	1.94	5.00	Corn, rice, wheat, Kaffir corn, millet and hulled oats.
	S. Smedley & Son, Glassboro, N. J.									
180012	Laysum Dry Mash	Glassboro	10.30	19.63	20.00	6.36	6.00	6.63	7.00	Wheat bran and middlings, alfalfa meal, corn meal, corn gluten feed, linseed oil meal, ground oats, cottonseed meal, beef scrap and salt.

	J. C. Smith & Wallace Co., Newark, N. J.									
18355	Prize Scratch Feed	Murray Hill	11.16	11.88	10.00	2.77	2.50	2.60	5.00	Corn, wheat, buckwheat, barley, oats, Kaffir corn and sunflower seed.
	Jos. Smith & Co., Stockton, N. J.									
18475	Smith's Scratch Feed	Stockton	11.83	9.94	10.00	3.05	3.00	2.30	4.00	Wheat, cracked corn, oats, barley, Kaffir corn, buckwheat and sunflower seed.
18474	Smith's Dry Mash	Stockton	8.18	19.44	14.00	4.57	4.00	11.18	15.00	Beef scrap, charcoal, alfalfa, wheat middlings, wheat bran, ground oats, hominy feed and corn gluten feed.
	T. C. Souder & Son, Millville, N. J.									
180028	Souder's Scratch Feed	Millville	12.60	10.44	10.00	3.75	1.50	3.19	6.00	Cracked corn, oats, wheat screenings, barley, milo-maize or Kaffir corn, sunflower seed, buckwheat and charcoal.
	Spratt's Patent, Ltd., Newark, N. J.									
18621	Spratt's Poultry Food	Newark	6.68	20.44	20.00	3.35	1.75	1.02	2.00	Wheat flour, meat and bone cooked and ground mustard.
18623	Spratt's Growing Mash Food	Newark	8.51	22.31	22.00	5.38	4.50	4.21	8.00	Wheat bran, wheat, corn meal, alfalfa meal, ground meat, ground rice, ground Kaffir corn, ground buckwheat, ground bone, ground charcoal and ground peas.
18624	Spratt's Chicgrain	Newark	10.31	15.31	14.00	3.78	3.00	3.71	5.00	Whole or ground: wheat flour, wheat, millet, canary seed, Kaffir corn, hemp, green peas, buckwheat, popcorn, rice, meat, charcoal, bone and Mexican peas.
18626	Spratt's Utility Mash Food	Newark	12.79	21.69	20.00	5.56	4.50	7.07	7.00	Wheat bran, wheat, corn meal, alfalfa meal, ground meat, ground rice, ground Kaffir corn, ground buckwheat, ground bone, ground charcoal, ground peas, ground fish and vegetable meal.
18627	Spratt's Patent Egg Mash Food	Newark	7.81	22.31	22.00	5.03	4.50	5.76	8.00	Wheat bran, wheat, corn meal, alfalfa meal, ground meat, ground rice, ground Kaffir corn, ground buckwheat, ground bone, ground charcoal and ground peas.
18628	Spratt's Chick Meal	Newark	7.05	19.81	20.00	3.01	1.75	1.40	2.00	Wheat flour, meat and bone cooked and ground mustard.
18629	Spratt's Scratch Food	Newark	10.27	13.06	12.00	3.94	2.00	2.90	8.00	Whole or ground: wheat, millet, Kaffir corn, green peas, hemp, buckwheat, popcorn, rice, sunflower seed, field corn, meat, bone, barley and charcoal.
18630	Spratt's Developing Food	Newark	10.30	12.63	12.00	3.42	2.00	1.69	8.00	Whole or ground: corn, popcorn, meat, green peas, Kaffir corn, buckwheat, wheat, bone and Mexican peas.

POULTRY FOODS—New Jersey Manufacturers—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed	Principal Ingredients Guaranteed
	Stamets & Pursel, Phillipsburg, N. J.									
18445	Rising Sun Poultry Mash	Phillipsburg	11.28	16.38	10.00	4.02	3.00	4.38	5.00	Wheat bran, wheat middlings, corn chop, alfalfa, oil meal, corn gluten feed, beef scrap and ground oats.
	J. & A. Steinberg Co., Passaic, N. J.									
18144	Mixed Chicken Feed	Passaic	12.16	10.63	10.00	3.44	3.00	1.82	3.00	Cracked corn, whole corn, buckwheat, wheat, Kaffir corn and barley.
	S. A. Stewart, Woodbury, N. J.									
18989	Dry Mash	Woodbury	9.61	17.06	19.69	4.59	5.27	7.62	6.57	Wheat bran, wheat middlings, corn meal, alfalfa meal, corn gluten feed, ground meat and bone, charcoal and ground oats.
	Z. V. Stillwell, Villa Park, N. J.									
18832	Dry Mash	Villa Park	8.37	18.56	20.25	3.72	4.53	8.84	5.58	Wheat bran, corn meal, oats, linseed oil meal, meat scrap, charcoal, cottonseed meal, wheat middlings, corn gluten feed, alfalfa and Heneta.
	W. W. Supplee, Hampton, N. J.									
18421	Scratch Feed	Hampton	11.49	9.38	9.00	3.51	3.00	1.95	3.00	Cracked corn, wheat, oats, buckwheat, sunflower seed and Kaffir corn.
	Taylor Bros., Camden, N. J.									
18052	Keystone Developing Food	Camden	10.79	11.06	9.50	2.92	2.75	2.51	3.00	Wheat, corn, Kaffir corn, milo-maize and millet.
18054	Keystone Chick Food	Camden	10.88	12.13	11.00	4.71	3.00	2.23	3.00	Wheat, corn, Kaffir corn, milo-maize, millet, hulled oats and ground meat.
18055	Keystone Pigeon Food—A	Camden	11.46	15.56	13.00	3.21	3.00	2.22	4.00	Wheat, peas, Kaffir corn, milo-maize, buckwheat, millet, hemp and flint corn.
18056	Keystone Dry Mash	Camden	9.37	16.00	15.00	4.54	4.00	3.50	5.00	Wheat middlings, corn meal, wheat bran, ground oats, animal meal, bone meal, peanut meal, beet pulp, pea meal and salt.
18057	Keystone Duck Food	Camden	9.68	22.44	16.00	4.73	6.50	4.66	4.00	Prepared corn, ground meat, linseed oil meal, wheat middlings, pea meal, peanut meal, beet pulp and salt.
18058	Keystone Mash Food	Camden	9.79	12.63	13.00	2.61	3.00	6.90	10.00	Prepared wheat screenings, alfalfa meal, corn meal, peanut meal, beet pulp, pea meal and salt.
18059	Keystone Baby Chick Food	amden	9.55	13.00	13.00	4.49	4.00	3.11	3.00	Wheat, corn, Kaffir corn, milo-maize, oat groats, millet, ground meat, granulated milk, charcoal and 2% grit.

18060	Keystone Scratching Food	Camden	10.61	14.50	11.00	2.95	3.00	2.17	3.00	Wheat screenings, wheat, barley, Kaffir corn, milo-maize, millet, hemp, sunflower seed, buckwheat, corn and peas.
18061	Keystone Forcing Food	Camden	9.51	13.63	12.50	4.54	4.00	4.31	3.00	Corn meal, ground wheat, beet pulp, raw bone meal, ground meat, pea meal and salt.
18062	Dandy Chick Food	Camden	10.50	11.94	10.00	4.33	3.00	2.46	3.00	Wheat screenings, corn, Kaffir corn, millet, hulled oats and barley.
18063	Dandy Scratching Food	Camden	10.67	10.50	10.50	3.08	3.00	2.56	3.00	Wheat screenings, wheat, barley, millet, sunflower seed, buckwheat, prepared corn, peas, shell and grit.
18064	Uncle Sam Scratching Food	Camden	10.24	10.00	9.75	3.24	4.50	1.91	3.00	Wheat, barley, Kaffir corn, milo-maize, hemp, sunflower seen, buckwheat and prepared corn.
18065	Keystone Laying Food	Camden	8.11	20.44	18.75	4.51	4.00	7.95	9.00	Alfalfa meal, cottonseed meal, prepared corn, ground meat, bone meal, wheat middlings, shell dust, peanut meal, beet pulp, salt, mustard and oil cake meal.
18066	Keystone Fish Mash Food	Camden	9.25	17.81	12.00	4.99	3.00	4.84	3.00	Wheat bran, corn meal; fish scrap, feed flour, ground meat, pea meal and wheat middlings.
18067	Keystone Pheasant Food	Camden	9.82	13.38	12.00	3.52	3.00	2.06	3.00	Ground meat, ground bone, millet, Kaffir corn, milo-maize, rice and white cracked corn.
	Terhune's Poultry Supply & Feed Co., Hackensack, N. J.									
18084	Terhune's Laying Mash	Hackensack	9.39	18.88	18.00	5.51	3.00	6.27	10.00	Wheat bran and middlings, corn meal, corn gluten feed, ground oats, meat scrap, ground alfalfa, linseed oil meal and charcoal.
	Thatcher & Barnum, Hoboken, N. J.									
18093	T & B Baby Chick Feed—No Grit	Englewood	11.01	9.75	10.00	2.88	2.50	2.23	5.00	Corn, wheat, Kaffir corn and millet.
18075	T. & B Pigeon Feed	Hackensack	11.20	11.13	10.00	2.77	2.50	1.65	5.00	Cracked corn, wheat, Kaffir corn, buckwheat and peas.
18094	T & B Chicken Feed	Homestead	10.60	10.31	9.00	3.94	3.00	2.00	4.00	Whole corn, wheat, barley and buckwheat.
18095	T & B Dry Mash	Leonia	8.32	17.13	18.00	5.19	5.00	7.63	8.00	Wheat bran, corn meal, wheat middlings, linseed oil meal, meat scrap and ground oats.
18096	T & B Scratch Mixeture	Leonia	10.35	10.31	10.00	3.57	2.50	2.31	5.00	Cracked corn, wheat, oats, barley, Kaffir corn, buckwheat and sunflower seed.
	J. A. Tiger, Califon, N. J.									
18385	Tiger's Poultry Grains	Califon	11.63	10.19	8.00	3.39	2.00	2.03	3.00	Cracked corn, wheat, barley, buckwheat, Kaffir corn and sunflower seed.
18386	Dry Mash	Califon	9.78	18.69	16.00	4.55	3.00	12.15	8.00	Oats, wheat bran, wheat middlings, alfalfa meal, corn meal, meat and beef scrap.

POULTRY FOODS—New Jersey Manufacturers—(Continued)

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Fiber Found	Fiber Guaranteed	Principal Ingredients Guaranteed
	W. N. Tilton, Englewood, N. J.									
18090	Mash	Englewood	8.89	13.44	10.00	4.22	2.50	9.49	10.00	Corn, oats, alfalfa, wheat bran, wheat middlings and corn gluten meal.
	W. S. Vroom, Somerville, N. J.									
18741	Vroom's Perfect Mash	Somerville	9.65	15.50	14.00	4.00	5.00	7.07	10.00	Wheat barn, corn meal, ground oats, wheat middlings, corn gluten feed, alfalfa meal and beef scrap.
18742	Vroom's Scratching Feed	Somerville	11.96	9.81	8.00	3.65	3.00	2.39	4.00	Wheat, cracked corn, oats, buckwheat and charcoal.
	Wannemacher & Weiss Co., Passaic, N. J.									
18178	J. P. Dry Mash	Passaic	8.12	20.00	17.25	5.26	5.14	8.53	9.17	Wheat bran, wheat middlings, ground oats, corn meal, gluten meal, meat scrap, high grade alfalfa and oil meal.
	Wilkinson, Gaddis & Co., Newark, N. J.									
18667	Ideal Scratch Feed	Newark	14.86	9.19	10.50	2.98	2.56	1.81	4.00	Kaffir corn, wheat, barley, buckwheat, sunflower seed and corn.
18668	Wilco Scratch Feed	Newark	14.28	10.38	10.00	3.56	4.00	2.48	5.50	Corn, wheat, barley, Kaffir corn, buckwheat and sunflower seed.
18669	Ideal Chick Feed	Newark	10.62	10.75	10.00	3.35	3.50	1.70	3.00	Corn, Kaffir corn, wheat, oat meal, millet, rape and hemp seed.
18670	Ideal Mash	Newark	8.91	14.81	20.00	4.10	3.50	7.51	14.00	Wheat bran, wheat middlings, oats, corn gluten feed, alfalfa, poultry meat and corn meal.
	G. Z. Williams, Great Meadows, N. J.									
18424	Meadow Queen Poultry Mash	Great Meadows.	10.07	18.50	17.00	4.88	4.50	6.34	9.00	Corn, oats, alfalfa, oil meal and beef scrap.
	Burt. H. Winchester, Newark, N. J.									
18606	Winco Scratch Feed—No Grit	Trenton	11.73	11.00	10.00	2.81	2.50	2.04	5.00	Corn, wheat, barley, oats, Kaffir corn, buckwheat, sunflower seed and linseed oil cake.
	Thos. Wood, Montclair, N. J.									
18693	Merit Dry Mash	Montclair	10.37	18.00	17.25	4.48	4.50	5.89	8.00	Wheat bran, wheat middlings, corn meal, corn gluten feed, ground oats, oil meal, alfalfa meal, beef scrap and 1% salt.
18694	Merit Scratching Grains	Montclair	11.98	10.56	10.00	2.90	3.00	2.09	5.00	Corn, oats, buckwheat, barley, Kaffir corn, wheat and sunflower seed.

	Vernon Wortman, Pottersville, N. J.									
18364	Namtrow Dry Mash	Pottersville	9.89	17.06	15.50	4.92	4.50	8.39	9.50	Wheat bran, meat scrap, wheat middlings, corn meal, ground oats, charcoal and alfalfa meal.
	J. R. Wyckoff, Princeton Junction, N. J.									
18571	Mercer Poultry Mash	Princeton Jct. .	7.68	23.81	21.98	6.09	4.92	7.21	7.10	Corn gluten feed, wheat middlings, wheat bran, corn meal, ground oats, meat scrap and alfalfa meal.
18573	Mercer Scratching Grains	Princeton Jct. .	10.85	10.38	11.23	2.91	3.54	2.17	2.60	Cracked corn, wheat, barley, buckwheat, Kaffir corn and sunflower seed.
	W. H. H. Wyckoff Co., Somerville, N. J.									
18756	Wyckoff's Chick Feed	Somerville	8.75	10.88	10.00	3.72	3.00	3.03	5.00	Cracked wheat, corn, Kaffir corn, peas, pin head oats, Heneta, grit and charcoal.
18757	Wyckoff's Scratch Food	Somerville	10.72	10.13	8.25	3.07	2.30	2.95	5.13	Wheat, barley, cracked corn, oats, buckwheat, Kaffir corn, sunflower seed, charcoal, grit, oyster shell and Heneta.
18758	Wyckoff's Dry Mash	Somerville	6.49	14.31	12.00	3.35	2.50	6.27	9.41	Corn meal, wheat bran, beef meal, oil meal, corn gluten meal, wheat middlings, alfalfa, ground oats and Heneta.
18762	Wyckoff's Pigeon Feed	Somerville	10.50	13.06	10.00	2.98	2.50	2.32	5.00	Cracked corn, wheat, buckwheat, hulled oats, red and white Kaffir corn, peas, millet and barley.

CALF MEALS

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein		Fat		Fiber		Principal Ingredients Guaranteed
				Found	Guaranteed	Found	Guaranteed	Found	Guaranteed	
18564	American Milling Co., Peoria, Ill. Sucrene Calf Meal	Trenton	10.40	16.56	20.00	4.01	4.00	4.17	3.00	Soluble blood flour, bone meal, soluble starch, malt flour, dried skimmed milk, corn meal, linseed meal and flour middlings.
18507	Frank Bird, Flemington, N. J. Calf Meal	Flemington	8.46	17.88	12.50	6.55	4.00	3.03	1.50	Rolled oats, puffed wheat, puffed rice and burnt popcorn.
18282	Blatchford's Calf Meal Factory, Waukegan, Ill. Blatchford's Calf Meal	Dover	10.40	23.94	24.00	6.20	5.00	6.85	6.75	Locust bean meal, unpressed flaxseed, wheat flour, blood flour, barley and malt sprout meal, ground peas and beans, rice polish, O. P. oil meal, cocoa shell meal, cocoanut meal, recleaned cottonseed meal, foenugreek, dried milk, anise and salt.
18821	J. W. Eshelman, Lancaster, Pa. Calf Meal	Spotswood	9.98	19.50	16.00	4.79	3.00	5.78	3.00	Cooked and baked wheat feed, wheat flour, linseed meal, wheat middlings, ground flaxseed, oat meal and blood meal.
18255	Quaker Oats Co., Chicago, Ill. Schumacher Calf Meal	Newton	7.82	18.75	18.00	10.23	8.00	2.66	4.00	Oat meal, wheat meal, ground flaxseed, milk, albumen, cottonseed meal and ½ of 1% carbonate of soda.
18526	Ralston-Purina Co., St. Louis, Mo. Purina Calf Chow	Ringoes	10.36	33.50	33.00	3.81	4.00	3.89	3.50	Blood flour, linseed meal, hominy feed and wheat flour.
18199	Ryde & Co., Chicago, Ill. Ryde's Cream Calf Meal	Boonton	9.45	23.88	25.00	4.60	5.00	6.93	6.00	Ground flaxseed, wheat flour, locust bean meal, recleaned cottonseed meal, blood flour, beans and peas, cocoa shell meal, hominy feed, foenugreek, anise and salt.
18625	Spratt's Patent, Ltd., Newark, N. J. Spratt's Calf Meal	Newark	8.12	19.50	25.00	2.99	4.00	3.43	4.00	Linseed meal, wheat flour, corn meal, ground meat, cottonseed meal, ground peas and alfalfa meal.

POULTRY MEAT

Station Number	Manufacturer or Jobber and Dealer	Place of Sampling	Moisture	Protein Found	Protein Guaranteed	Fat Found	Fat Guaranteed	Phosphoric Acid Found
	American Agricultural Chemical Co., New York City.							
8222	Protox Pure Ground Meat Scrap	Westwood	7.60	51.88	55.00	14.35	10.00	7.39
	Baugh & Sons Co., Philadelphia, Pa.							
8203	Baugh's XX Beef Scrap for Poultry	Camden	4.22	50.25	45.00	20.15	10.00	8.30
	The Berg Co., Philadelphia, Pa.							
8529	Berg's 3 Medal Poultry Meat	Pennington	5.93	40.19	40.00	14.96	11.00	12.34
	Henry Clausen, Teaneck, N. J.							
8209	Meat and Bone Scrap	Oradell	6.54	47.19	45.00	19.37	15.00	7.00
	Consolidated Dressed Beef Co., Phila., Pa.							
8047	Consolidated Beef and Bone Scrap	Camden	6.05	39.94	45.00	15.17	12.00	12.95
	Enterprise Tallow & Grease Co., Phila., Pa.							
8015	Beef Scrap	Mullica Hill	9.04	47.81	45.00	12.58	12.00	8.60
	The Flavell Co., Asbury Park, N. J.							
8837	Vim Beef Cracklings	Manasquan	7.75	50.00	50.00	13.08	15.00	9.98
	The Fritz Co., Philadelphia, Pa.							
8434	Quaker City Special Brand Meat and Bone Scrap	Washington	6.07	36.94	40.00	13.80	10.00	14.13
	International Glue Co., Boston, Mass.							
8011	*Red Star Brand Fish Scrap	Hammonton	6.66	41.63	45.00	3.06	2.00	17.90
	Maurer Mfg. Co., Inc., Elizabeth, N. J.							
8164	Kwality Meat Scrap	Paterson	6.23	49.38	50.00	16.57	10.00	9.13
	Noll and Fisher, Newark, N. J.							
8376	Noll and Fisher Meat Scrap	German Valley	8.54	45.69	48.00	12.44	12.00	11.07
	Russia Cement Co., Gloucester, Mass.							
8812	*Chic Chuk	Freehold	5.48	49.19	50.00	1.19	2.00	17.12
	Sharpless & Bro., Camden, N. J.							
8030	Royal Poultry Meat and Bone Scrap	Camden	6.74	50.19	50.00	14.62	10.00	9.27
	M. L. Shoemaker & Co., Ltd., Phila., Pa.							
8922	Ground Beef Scrap	Moorestown	8.98	56.25	55.00	14.39	10.00	5.60
	Sitley & Son, Inc., Camden, N. J.							
8008	Peerless Prepared Poultry Meat	Camden	5.55	41.63	50.00	14.58	14.00	12.65
	Spratt's Patent, Ltd., Newark, N. J.							
8622	Spratt's Ground Meat Scrap	Newark	7.27	48.06	43.00	11.77	10.00	8.37
	John T. Stanley Co., Inc., New York City.							
8108	Stanley's High Protein Meat Scrap	Fort Lee	9.02	42.00	45.00	9.68	10.00	9.75
	Swift & Co., Harriston Sta., Newark, N. J.							
8078	Laymore Meat Scrap	Hackensack	6.83	48.31	45.00	13.00	8.00	11.36
8559	Eureka Meat Scrap	Princeton Jct.	5.57	44.06	55.00	16.13	8.00	11.77
8267	*Digester Tankage	Netcong	6.52	56.75	60.00	8.92	6.00	7.57
8153	*Poultry Bone	Paterson	6.44	21.88	25.00	4.99	5.00	23.62
	Taylor Bros, Camden, N. J.							
8053	Special Prepared Poultry Meat	Camden	5.71	40.44	50.00	16.00	14.00	13.09
	The Van Iderstine Co., Long Island City, N. Y.							
8046	Darling's High Protein Meat Scrap	Camden	10.12	54.19	55.00	10.97	5.00	7.51
8852	Darling's Pure Ground Meat Scrap	Allentown	5.97	47.13	45.00	12.64	5.00	8.12
	Average	....	6.99	46.58	.....	14.31	.....	9.92

*Not included in the average.

REGISTRATIONS FOR YEAR 1918

The following list gives the names and addresses of the manufacturers who have registered one or more brands of feeding stuffs that will be offered for sale during the year 1918. The detailed information regarding these brands is not given, but information will be furnished upon request concerning any particular brand that has been registered.

A

Acme-Evans Co.	Indianapolis, Ind.
Alabama Black Belt Co.	Montgomery, Ala.
Henry Allen	Eatontown, N. J.
American Agricultural Chemical Co.	New York City.
American Hominy Co.	Indianapolis, Ind.
American Linseed Co.	New York City.
American Maize-Products Co.	New York City.
American Milling Co.	Peoria, Ill.
Anderson Grain Co., Inc.	Buffalo, N. Y.
Samuel Anderson	Hammonton, N. J.
Animal Products Co.	Philadelphia, Pa.
D. C. Apgar	Ralston, N. J.
J. W. Apgar	Glen Gardner, N. J.
Henry R. Applegate	Hightstown, N. J.
Arcady Farms Milling Co.	Chicago, Ill.
Archer-Daniels Linseed Co.	Buffalo, N. Y.
Arkadelphia Milling Co.	Arkadelphia, Ark.
Armour Grain Co.	Chicago, Ill.
Armstrong & Demarest	Lafayette, N. J.
Ashcraft-Wilkinson Co.	Atlanta, Ga.
Frank Atherton Grain Co.	Paterson, N. J.
Atlantic Export Co.	New York City.
Atlas Feed & Milling Co.	Peoria, Ill.
C. C. Avis	Woodstown, N. J.

B

J. J. Badenoch Co.	Chicago, Ill.
Franklin Baker Co.	Brooklyn, N. Y.
Dwight M. Baldwin, Jr.	Minneapolis, Minn.
Baldwin, Prince & Co.	Norfolk, Va.
P. Ballantine & Sons	Newark, N. J.
Baltimore Pearl Hominy Co.	Baltimore, Md.
Barber Milling Co.	Minneapolis, Minn.
M. F. Baringer	Philadelphia, Pa.
Barker & Higgins	Bernardsville, N. J.
W. P. Battle & Co.	Memphis, Tenn.
Baugh & Sons Co.	Philadelphia, Pa.
Bay State Milling Co.	Winona, Minn.
H. U. Bean & Co.	Philadelphia, Pa.
Warren Beaty	Hackettstown, N. J.

B. M. Beideman	Merchantville, N. J.
H. Beidler & Co.	Philadelphia, Pa.
Samuel Bell & Sons	Philadelphia, Pa.
Belvidere Flouring Mill Co.	Belvidere, N. J.
George B. Benedict	Elizabeth, N. J.
The Berg Company	Philadelphia, Pa.
Bernet, Craft & Kauffman Milling Co.	St. Louis, Mo.
Big Diamond Mills Co.	Minneapolis, Minn.
Frank Bird	Flemington, N. J.
Fred R. Blamey	Bloomfield, N. J.
Blank & Gottshall	Sunbury, Pa.
Blatchford's Calf Meal Factory	Waukegan, Ill.
H. H. Blauvelt	Ridgewood, N. J.
George Boggs & Son	West Collingswood, N. J.
J. Bolgiano & Son	Baltimore, Md.
Boston Molasses Feed Co.	Boston, Mass.
F. R. Boyd	Medford, N. J.
George E. Brisbin & Co.	Clyde, N. Y.
F. W. Brode & Co.	Memphis, Tenn.
Buckeye Cereal Co.	Massillon, O.
Buckeye Cotton Oil Co.	Cincinnati, O.
Buffalo Cereal Co.	Buffalo, N. Y.
Burtis, Conine & Son	Allentown, N. J.
Bushkill Milling Co.	Easton, Pa.

C

L. G. Campbell Milling Co.	Northfield, Minn.
Campbell, Morrell & Co.	Passaic, N. J.
Carpenter & Knight, Inc.	Morristown, N. J.
Carscallen & Cassidy	Jersey City, N. J.
Chapin & Company	Chicago, Ill.
Henry Clausen	Teaneck, N. J.
Clover Leaf Milling Co.	Buffalo, N. Y.
C. S. Coleman & Co.	Philadelphia, Pa.
Charles Collet	Jersey City, N. J.
J. S. Collins & Son, Inc.	Moorestown, N. J.
Commander Mill Co.	Minneapolis, Minn.
Commercial Mills & Elevator	Plainfield, N. J.
The G. E. Conkey Co.	Cleveland, O.
E. W. Conklin & Son, Inc.	Binghamton, N. Y.
J. M. Conover & Son	Bartley, N. J.
Consolidated Dressed Beef Co.	Philadelphia, Pa.
Consumers Coal Co.	Plainfield, N. J.
Corn Products Refining Co.	New York City.
Corno Mills Co.	St. Louis, Mo.
George Cox & Sons	West Hoboken, N. J.
Thomas Craig	Buttzville, N. J.
Aaron D. Crane	Elizabeth, N. J.

W. A. Crowell & Son ....Metuchen, N. J.
Curtis & Laire ....Pittstown, N. J.
A. Cyphers Company ....Newark, N. J.

D

Darling & Company ....Chicago, Ill.
J. G. Davis Company ....Rochester, N. Y.
J. Sanford Davis ....Greenwich, N. J.
S. P. Davis ....Little Rock, Ark.
E. H. Deats ....Pittstown, N. J.
Decker & Simmons ....Sussex, N. J.
C. C. Dempsey & Co. ....Gloucester City, N. J.
Denver Alfalfa Milling & Products Co. ....Hartman, Colo.
Deposit Milling Co. ....Deposit, N. Y.
Deutsch & Sickert Co. ....Milwaukee, Wis.
Albert Dickinson Co. ....Chicago, Ill.
Dixie Mills Co. ....East St. Louis, Ill.
Jacob Dold Packing Co. ....Buffalo, N. Y.
The Douglas Company ....Cedar Rapids, Iowa.
N. Drake ....Newark, N. J.
Duluth-Superior Milling Co. ....Duluth, Minn.
Ezl. Dunwoody Co. ....Philadelphia, Pa.

E

Eagle Roller Mill Co. ....New Ulm, Minn.
R. D. Eaton Grain & Feed Co. ....Norwich, N. Y.
Jonas F. Eby & Son ....Lancaster, Pa.
B. A. Eckhart Milling Co. ....Chicago, Ill.
Economic Feed Co. ....Peekskill, N. Y.
Eldredge & Phillips, Inc. ....Cape May City, N. J.
Empire Cotton Oil Co. ....Atlanta, Ga.
Empire Grain & Elevator Co. ....Binghamton, N. Y.
Enterprise Tallow & Grease Co. ....Philadelphia, Pa.
John W. Eshelman ....Lancaster, Pa.
Evans Milling Co. ....Indianapolis, Ind.
Everett, Aughenbaugh & Co. ....Waseca, Minn.
Ewen Milling Co. ....Alloway, N. J.
Excello Feed Milling Co. ....St. Joseph, Mo.

F

Fairfield Dairy Supply Co. ....Little Falls, N. J.
Farmers Feed Co. ....New York City.
Felt Bros. & Gage Co. ....Olean, N. Y.
Ferger Grain Co. ....Cincinnati, O.
The Flavell Co. ....Asbury Park, N. J.
The Fleischmann Co. ....Peekskill, N. Y.
Flemington Jct. Cereal & Flour Mills ....Flemington Jct., N. J.
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G

C. A. Gambrill Manufacturing Co. .... Baltimore, Md.
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Gross Bros. .... Hightstown, N. J.
Walter H. Grove .... Flanders, N. J.
J. H. Grover & Son .... Princeton Jct., N. J.

H

Hackensack Grain & Hay Co. .... Hackensack, N. J.
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Alvin Hill & Son .... Flemington, N. J.
G. F. Hill & Co. .... Gladstone, N. J.
The H. O. Company .... Buffalo, N. Y.
I. A. Hoffman & Son .... German Valley, N. J.
Holley & Smith .... Hackensack, N. J.
E. Hollingshead .... Moorestown, N. J.
Hopkins & Merrell Co. .... Branchville, N. J.
Hottelet Company .... Milwaukee, Wis.
J. A. Howell .... Middletown, N. Y.
Howell Sons .... Trenton, N. J.
J. C. Hubinger Bros. Co. .... Keokuk, Iowa.
W. F. Hummer .... Milford, N. J.
Humphreys-Godwin Co. .... Memphis, Tenn.
J. R. Hunt .... Princeton, N. J.
Hutchinson Bros. .... Crosswicks, N. J.
E. C. Hutchinson Milling Co. .... Trenton, N. J.

I

Ideal Rendering Co.	North Wales, Pa.
Indiana Milling Co.	Terre Haute, Ind.
H. B. Ingersoll	Hamburg, N. J.
International Glue Co.	Boston, Mass.
International Sugar Feed Co.	Minneapolis, Minn.

J

Jamestown Electric Mills	Jamestown, N. Y.
W. J. Jennison Co.	Minneapolis, Minn.
Johnson Bros.	Bridgeton, N. J.
R. S. Johnson	Bridgeton, N. J.
Martin B. Jones & Co.	New York City.

K

Kasco Mills	Waverley, N. Y.
Edward G. Kaufer	Fort Lee, N. J.
Keever Starch Co.	Columbus, O.
Spencer Kellogg & Sons, Inc.	Buffalo, N. Y.
Kelloggs & Miller	Amsterdam, N. Y.
Kemper Mill & Elevator Co.	Kansas City, Mo.
Kirby Bros.	Medford, N. J.
George H. Kirby & Son	Allentown, N. J.
J. C. Klauder Estate	Philadelphia, Pa.
John P. Klug	New Milford, N. J.
Kornfalfa Feed Milling Co.	Kansas City, Mo.
Charles A. Krause Milling Co.	Milwaukee, Wis.
G. Krueger Brewing Co.	Newark, N. J.
Kuestner Bros.	Trenton, N. J.

L

Charles L. Lade	Morristown, N. J.
Lambert & Kerr	Lambertville, N. J.
Lancaster Mill & Elevator Co.	Lancaster, Pa.
Lanier Bros.	Nashville, Tenn.
J. P. Larison	Washington, N. J.
Larrowe Milling Co.	Detroit, Mich.
Lea Milling Co.	Wilmington, Del.
Frank LeBar	Stroudsburg, Pa.
E. K. Lemont & Son	Philadelphia, Pa.
C. H. Leonard Co.	Boonton, N. J.
John C. Liken & Co.	Sebewaing, Mich.
Listman Mill Co.	LaCrosse, Wis.
Little & Wilson	Pittstown, N. J.
Long Dock Mills	Jersey City, N. J.
Lunger Grain & Elevator Co.	Netcong, N. J.
Lyle & Lyle	Huntsville, Ala.

M

G. G. MacPherson ....Lebanon, N. J.
Mann & Allshouse ....Easton, Pa.
Mann Bros Co. ....Buffalo, N. Y.
The Manning Co. ....Sussex, N. J.
Maritime Trading Corporation ....New York City.
Martenis Bros. ....New York City.
D. B. Martin Co. ....Philadelphia, Pa.
Maurer Manufacturing Co., Inc. ....Newark, N. J.
Mauser & Cressman ....Catasauqua, Pa.
Mauser Mill Co. ....Treichlers, Pa.
McMurtrie Milling Co. ....Belvidere, N. J.
Meader-Atlas Co. ....New York City.
Clifford Mehrhof, Inc. ....Ridgefield, N. J.
Memphis Cotton Hull & Fiber Co., Ltd. ....Memphis, Tenn.
Mercer Milling Co. ....Wilburtha, N. J.
Merchants Wholesale Grocery Co. ....Philadelphia, Pa.
Meridian Grain & Elevator Co. ....Meridian, Miss.
Messler & Shannon ....Blairstown, N. J.
Metropolitan Mills ....New York City.
Metzger Seed & Oil Co. ....Toledo, O.
Meyer & DeVogel ....Paterson, N. J.
Midland Linseed Products Co. ....Minneapolis, Minn.
Midland Milling Co. ....Kansas City, Mo.
Millbourne Mills ....Philadelphia, Pa.
H. N. Miller ....Peapack, N. J.
V. T. Miller ....Manasquan, N. J.
Millville Flour & Grain Co. ....Millville, N. J.
Miner-Hillard Milling Co. ....Wilkesbarre, Pa.
C. P. Mohrfeld ....Collingswood, N. J.
C. L. Montgomery & Co. ....Memphis, Tenn.
George Q. Moon & Co. ....Binghamton, N. Y.
Mystic Milling & Feed Co. ....Rochester, N. Y.

N

National Feed Co. ....St. Louis, Mo.
National Oats Co. ....St. Louis, Mo.
Neighbor & Son ....Califon, N. J.
K. & E. Neumond ....St. Louis, Mo.
Neustadt & Co. ....New York City.
Nischwitz & Son ....Plainfield, N. J.
Noblesville Milling Co. ....Noblesville, Ind.
Noll & Fischer ....Newark, N. J.
Northwestern Consolidated Milling Co. ....Minneapolis, Minn.
Northwestern Elevator & Mill Co. ....Toledo, O.
W. C. Nothern ....Little Rock, Ark.
Nowak Milling Corporation ....Buffalo, N. Y.
Nucoa Butter Co. ....Bayonne, N. J.
Jesse H. Nunn ....Bartley, N. J.

O

Peter O'Blenis .... Paterson, N. J.
R. J. O'Brien & Bros Co. .... Passaic, N. J.
Oil Seeds Co. .... Bayonne, N. J.
O. K. Company .... New York City.
Omaha Alfalfa Milling Co. .... Omaha, Neb.
Oradell Flour, Feed & Grain Co. .... Oradell, N. J.
Charles C. Ort .... Hackettstown, N. J.

P

Park & Pollard Co. .... Boston, Mass.
Patent Cereals Co. .... Geneva, N. Y.
Penn Grains & Feed Co. .... Philadelphia, Pa.
Penwell Mills, Inc. .... Port Murray, N. J.
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Q

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R

Ralston-Purina Co. .... St. Louis, Mo.
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Ryde & Company .... Chicago, Ill.

S

Saeger Milling Co. .... Allentown, Pa.
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Nicholas Scholl .... Newark, N. J.
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S. Alfred Seely Co. .... Spencer, N. Y.
Shane Bros. & Wilson Co. .... Minneapolis, Minn.
Sharpless & Bro. .... Camden, N. J.
Sheffield-King Milling Co. .... Minneapolis, Minn.
Sherwin-Williams Co. .... Cleveland, O.
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The Shoemaker Co. .... Oakwood, N. Y.
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Simpson, Hendee & Co. .... New York City.
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Smith, Parry & Co. .... Milwaukee, Wis.
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J. E. Soper Co. .... Boston, Mass.
T. C. Souder & Son .... Millville, N. J.
South Branch Mill .... South Branch, N. J.
South Jersey Farmers Exchange .... Woodstown, N. J.
Southwestern Milling Co. .... Kansas City, Mo.
Sparks Milling Co. .... Alton, Ill.
Spratt's Patent (Am.) Ltd. .... Newark, N. J.
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Stamets & Pursel .... Phillipsburg, N. J.
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John T. Stanley Co., Inc. .... New York City.
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T

Taylor Bros. .... Camden, N. J.
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W. & W. E. Thomas .... Milford, N. J.
A. Thompson & Co. .... Trenton, N. J.
Nelson Thompson & Co. .... Kingston, N. J.
Thompson & Mould .... Goshen, N. Y.
J. A. Tiger .... Califon, N. J.
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Tioga Mill & Elevator Co. .... Waverly, N. Y.
Toledo Elevator .... Indianapolis, Ind.
Turnerville Roller Mills .... Sewell, N. J.
Joseph F. Tuttle .... Rockaway, N. J.

U

Ubiko Milling Co. .... Cincinnati, O.
Union Grain Co. .... Plainfield, N. J.
Union Seed & Fertilizer Co. .... New York City.
George Urban Milling Co. .... Buffalo, N. Y.

V

A. J. Van Den Berg .... North Paterson, N. J.
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Virginia Feed & Milling Corporation .... Alexandria, Va.
William S. Vroom .... Somerville, N. J.
E. J. Vusler .... Hope, N. J.

W

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L. R. Wallace .... Middletown, N. Y.
Walters Milling Co. .... Philadelphia, Pa.
Walton Bros. .... Philadelphia, Pa.
Wannemacher & Weis Co. .... Passaic, N. J.
Washburn-Crosby Co. .... Minneapolis, Minn.
Wash-Co Alfalfa Milling Co. .... Fort Calhoun, Neb.
J. F. Weinmann Milling Co. .... Little Rock, Ark.
Otto Weiss Milling Co. .... Wichita, Kan.
Henry G. Werner .... Deans, N. J.

Western Grain Products Co.	Hammond, Ind.
Western Grains & Feed Co.	Chicago, Ill.
Westwood Feed Co.	Westwood, N. J.
Fred D. Wikoff Co.	Red Bank, N. J.
Wilkinson, Gaddis & Co.	Newark, N. J.
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G. Z. Williams	Great Meadows, N. J.
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Wolff Bros.	Paterson, N. J.
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Jacob R. Wyckoff	Princeton Jct., N. J.
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Wm. H. H. Wyckoff Co.	Somerville, N. J.

Y

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George O. Young	Andover, N. J.

New Jersey

Agricultural Experiment Stations

BULLETIN 328

Sprayed Unsprayed
Effect of proper spraying

SOME IMPORTANT ORCHARD PLANT LICE

New Brunswick, N. J.

NEW JERSEY AGRICULTURAL EXPERIMENT STATIONS*

NEW BRUNSWICK, N. J.

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* Staff list revised to June 30, 1918.

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CONTENTS

ILLUSTRATIONS

New Jersey Agricultural Experiment Stations

BULLETIN 328

FEBRUARY 15, 1918

Some Important Orchard Plant Lice

BY

Thomas J. Headlee, Ph.D.

In winter, small (1/50 of an inch long) shining-black oval eggs on the roughened places or close to the buds of the small tender twigs of the apple tree; in spring and early summer, small variously colored lice congregated on the under-sides of the leaves causing them to curl up, die, and fall off, dwarfing the fruit and sometimes ruining the crop.

Introduction

Four species of plant lice are usually listed as commonly attacking the foliage and to some extent the fruit of the apple tree. All winter in the egg stage on the smaller branches and twigs of the trees. All hatch from the eggs and develop one or more generations on the tree. All except one—the green apple aphis—migrate from the apple to other plants. All return to the apple either the first or second fall following and lay the over-wintering eggs. The species concerned are the green apple aphis (*Aphis pomi* DeG.), the rosy apple aphis (*Aphis sorbi* Kalt.), the oat aphis (*Siphocoryne avenæ* Fab.) and the clover aphis (*Aphis bakeri* Cowsen).

In New Jersey the clover aphis has not been recorded. Until two years ago the green apple aphis was the only species regarded as a pest. In the season of 1915 the rosy apple aphis appeared in large numbers in almost all parts of the state and

did much damage. The failure of the usual methods of aphis control when this species appeared necessitated a study of the problem, and in the following account it is attempted to set forth the most important of the results obtained.

RECOGNITION MARKS

The stage in which the aphis is found throughout the winter and early spring is a small shining-black egg fastened to the bark of the twigs and smaller branches. They are likely to be laid on the tender ends of water sprouts, in the depressions about bud and pruning scars, or partly or completely inserted between the buds and the stem. The eggs of green apple aphis have in our experience been more commonly found on the water sprouts than those of either of the other species.

Fig. 1. First stage of the green, the rosy and the oat aphis
(After Parrott, Hodgkiss and Lathrop)

The newly-hatched lice of the green, the rosy, and the oat aphis are very small, dark-green in color and look much alike. Parrott, Hodgekiss, and Lathrop[1] have discovered differences by which one species may be told from another, and Dr. Alvah Peterson has found that the characters cited by them hold for New Jersey conditions.

The length of the antennæ, or feelers, and the size and shape of the cornicles, or honey tubes, are the points that we have found most useful in distinguishing the different species.

As these young develop into wingless stem-mothers, their characteristic differences become so distinct that recognition of

[1] Parrott, P. J., Hodgekiss, H. E., and Lathrop, F. H., 1917. Plant lice injurious to apple orchards. II. Studies on control of newly-hatched aphides. N. Y. (Geneva) Agr. Exp. Sta. Bul. 431.

TABLE OF DISTINGUISHING CHARACTERS

Species	Color	Head	Antennæ	Body	Honey tubes	Legs
Oat aphis	Extremely dark green	Two blackish rectangles	Short, reaching backward only to the middle pair of legs	Not powdery	Black, mere disks	Very dark
Green apple aphis	Dark green and lighter than the other species, varying to almost a brownish yellow	Dusky and rather brownish	Longer than the first and shorter than the second; blackened at tip	Slightly powdery	Short, conical	Dark tipped
Rosy apple aphis	Dark green	Dark with a pair of darker areas	Long, reaching almost to base of honey tube	Decidedly powdery; several rows of black tuberculate spots running lengthwise	Long, with expanded outer ends	Dark

the species becomes easy. The adult stem-mother of the oat aphis is pale yellowish green, with a darker streak along the middle line of the back, while that of the green apple aphis is bright green, and that of the rosy aphis has a slaty cast and is covered with powder.

NATURE AND EXTENT OF INJURY

As soon as each species hatches from the egg it attacks such of the young unfolding foliage as may be out. It works its mouth parts through the rind of the plant and sucks out the sap. As the flower buds are exposed by the development of the tree, they in turn are attacked.

Fig. 2. Injury to foliage

The wounding of the tissue and the withdrawal of sap upsets the rate of growth of the part attacked in such a fashion as to cause curling of foliage and distortion of the fruit.

The activity of the oat aphis causes little curling of the foliage, and as the second brood develops wings and leaves the tree by the time the fruit has well set, the trouble is soon past. To what extent the feeding on the buds and flower clusters may so weaken them as to prevent setting, we do not know, but it is possible that such an injury takes place.

The green apple aphis, like the preceding species, causes little curling of the foliage at the beginning of the season. Later its activity results in the most pronounced curling.

The rosy apple aphis, on the other hand, produces much curling of the foliage, probably because it devotes its attention more exclusively to the leaves.

Both the green apple aphis and the rosy, especially the latter, have done very serious injury to fruit, causing it to be knotted and gnarled and never to reach a salable size.

Recently it has been shown that plant lice can and do spread fire blight.[2] It is thought that such of them as hatch from eggs which were laid in blight cankers may carry the blight germ to other parts of the tree.

Fig. 3. Injury to fruit

The extent of the injury depends upon the abundance of the lice. When very plentiful the tree may be almost defoliated and the crop utterly ruined. In 1915 the injury was general throughout the state and orchards everywhere showed the work of plant lice. The season of 1916 showed a smaller amount of

[2] Merrill, J. H., 1917. Further data on the relation of aphides and fire blight (*Bacillius amylororus*). In Jour. Econ. Ent., v. 10, p. 45–47.

injury, and there was an epidemic of fire blight. As seen by the writer, there is no necessary connection between the epidemic and the aphis, because the aphis was worse in 1915 and 1917 than in 1916, while the fire blight was limited in these two years.

In 1915 Mr. John Barclay, of Cranbury, estimated the damage done his orchard by apple aphis at $40 an acre. This occurred in spite of the practice of what was then thought to be careful spraying for the insects.

LIFE HISTORY AND HABITS

All species pass the winter in the egg stage attached to the bark of the twigs and smaller branches of the trees. The green apple aphis appears to be partial to water sprouts, while the eggs of the other species are likely to be found in depressions about pruning, bud and fruit scars, or thrust almost or quite out of sight between the bud and stem.

The oat aphis was the first species to hatch at New Brunswick and vicinity in the spring of 1917. They were discovered on the buds on March 31. Then (about April 12 to 14) came the rosy aphis and green apple aphis almost coincidently. The difference in the time of hatching of the first two species was sufficiently great for the oat aphis to have hatched and reached the buds, and to have been destroyed by insecticides, while the rosy, at that time in the egg stage, hatched later and seriously damaged the foliage.

The oat aphis reached the buds as they were swelling and before any leaves were yet projecting, while the rosy came on only after the tiny leaves were projecting from forward buds like squirrel ears. The rosy aphis hatched at the same stage of bud development as in 1916. Inasmuch as the experience relative to time when the rosy aphis hatches differs in different parts of the country, the writer will quote from his notes in 1916: "Early in the forenoon Mr. Barclay called me over the telephone and told me that the aphis began emerging in his orchard in enormous numbers on the preceding afternoon (April 15, 1916). The day was clear and warm and the personal examination, which I made later in the morning, showed aphis present everywhere in large numbers. Nearly every flower bud on unsprayed trees showed at least one-half dozen specimens, while the buds on trees treated with 'Scalecide' or with winter-strength lime-sulfur in dormancy rarely exhibited more than one specimen to the bud. * * * At this time the most advanced cluster buds showed the first green leaves separating from the cluster, and the young leaves projecting from the opening buds like squirrel ears were

very common everywhere throughout the orchard." It is thus seen that for two years in the Barclay orchard, the rosy aphis hatched after the leaves began to emerge from the buds and at a time when shelter from spraying materials could be had. The second generation of the oat aphis developes wings and migrates from the apple to various grasses (species of *Poa*). Here they breed throughout the summer. It is thought that they pass the winter on grains and grasses and do not return to the apple until the second fall. At any rate, in the fall (late September or early October) winged forms of this species begin to appear on the apple, males and females are produced, and fertilized eggs are laid on the tree. Egg-laying may continue until December. The species may be found laying eggs on pear, quince, hawthorne, and plum trees.

The third generation of the rosy aphis is winged and migrates from the trees about the middle of June to plantains, where it remains throughout the summer, returning to the apple in late October and early November. Males and females are produced by the returned migrants and fertilized eggs are laid to pass the winter.

The green apple aphis lives on the apple, pear, quince, and hawthorne, especially the first, throughout the summer. The winged forms seem merely to spread the species to other parts of the tree or to other trees. In the fall (October) males and females are produced and fertilized eggs are laid for winter.

When the eggs are first laid they are yellowish in color and gradually become darker until they assume the normal shining black appearance.

It thus appears that the apple suffers from the oat and the rosy aphis during the early stages of fruit production only; the former leaving when the apples are just well set and the other in June. The green aphis, on the other hand, is on the trees continuously throughout the season.

Perhaps the most puzzling phase of the aphis problem is the fact that the plant lice are bad one year and hardly noticeable the next. The explanation for this puzzle appears to lie in the effect of the weather upon the aphids and their natural enemies.

The natural enemies of apple plant lice may be placed in two general groups—the parasitic enemies, which usually lay their eggs inside the body of the aphid, from which comes a grub that eventually destroyes the aphid, and the predaceous enemies, that attack, kill and consume the lice. The principal members of the first group belong to the *Hymenoptera*, or the group of bees, ants and wasps. These parasitic forms are usually very small and very greatly influenced by weather conditions.

The elements of climate which, because of their large variations, influence insect life to a great extent, are temperature and moisture, especially the former. It is therefore, to be expected that if weather has anything to do with the matter, temperature and moisture must be playing a large part. Perhaps the influence of these factors upon the relation existing between the plant lice and their natural enemies has been best illustrated by a study of *Lysiphelbus tritici*, a small hymenopterous (the order which includes the bees, ants and wasps) parasite of *Toxoptera graminum,* one of the most injurious of the plant lice attacking wheat and oats.

Under a constant temperature of 50° F. and an atmospheric moisture ranging from 75 to 100 per cent, 43 days were required for the parasite to develop from egg to adult. Furthermore, at this temperature, the number of healthy young produced is greatly reduced, in fact the insect hardly reproduces itself. On the other hand, under a temperature of 50° F. and the same atmospheric moisture the louse requires 24 days from birth to maturity and reproduces, once that stage has been reached, nearly one young a day for 27 days.

At a temperature of 70° F. the parasite can complete its life cycle in 10 days, and the average number of young ones from a single pair of parents amounts to 56. This means that in one month the offspring of a single pair would be more than 46,000. On the other hand, at a temperature of 70° F. the louse reaches maturity in 9 days and produces in the 11 days following about 29 young. At this rate in one month a single louse would produce less than 14,000 young.

It is thus seen that while with a low temperature the lice can carry on their activities practically unhindered by the parasite, the advent of high temperature is likely to be followed by their destruction by reason of the greater reproductive power of the parasite.

The studies of the effect of moisture are extremely limited, but such evidence as has been collected indicates that so long as the atmosphere is not too dry to prevent the vigor of the food plant and not wet enough to encourage the attack of parasitic fungi, variations in atmospheric moisture have little effect upon either the louse or its parasite.

No studies have been made to show the effect of climate upon the predaceous enemies. The lady-bird beetles and their larvæ are the only important forms that attack the lice under low temperatures and they are only rarely sufficiently abundant to prevent an outbreak.

In summing up the meager knowledge at hand relative to the effect of climatic conditions on the abundance of plant lice, we may say that a late cool spring is likely to show a serious attack of these insects, while an early warm one is likely to show few of them. On the other hand, it is quite possible that a late cool spring might not be accompanied by a plant louse outbreak because of the destructive effect of a late low temperature, or the activity of lady-bird beetles, or still other agencies less well understood.

It is also quite possible that an early warm spring might be accompanied by a plant louse pest by reason of an earlier reduction of the parasite.

Control

Determining Whether Control Measures Are Necessary

In view of the facts just presented showing the uncertainties of aphis outbreak, the first problem of the grower is to determine whether the conditions in his orchard render control measures necessary. If, as spring approaches, the water sprouts, twigs and smaller branches bear no aphis eggs, treatment for lice is unnecessary, for there will not be sufficient migration from adjacent orchards to create an infestation in the first half of the season. If, on the other hand, as spring approaches, aphis eggs are present on the water sprouts, twigs and smaller branches, treatments should be made as a matter of insurance against damage.

The small black eggs are rather inconspicuous and sharp eyes are required to find the first ones. After the grower has become familiar with their appearance he can pick them out without difficulty.

The Problem

When the eggs are present the problem of controlling the various species of apple aphis appears to involve the destruction of the specimens on the trees before they have a chance to do the damage to fruit and foliage. The aphis appears on the trees in the fall (October and November), and eggs laid by them carry over the winter until bud-opening time. The aphis must be attacked just before or during egg-laying in the fall, or while still in the form of the egg resting on the bark of the tree, or in the spring as a nymph that has just hatched.

Destroying the Aphis in the Fall

In the fall the return of the aphis usually covers a considerable period. In the late fall shining black eggs, immature yellowish eggs and adult aphids are found on the same twig. Anything short of several sprayings would seem to be doomed to failure as a method of control.

Destroying the Aphis in the Egg Stage

Throughout the winter and early spring the eggs remain on the tree, open to attack, and this would seem to be the logical time to compass their destruction. Many efforts have been made to find a substance which would destroy the aphis egg, not harm the tree, and sell for a price that would not prohibit its use. It can truthfully be said that up to the present time no such substance has been given to the public.

During the winter and spring of 1917, Dr. Peterson made a preliminary study of the egg and of the effects of certain chemicals upon it. He found that the egg envelope exhibits at least two layers—an outer semi-transparent brittle envelope (glutinous when the egg is first deposited) and an inner pigmented elastic membrane. A third layer may be seen as the nymph hatches, but this is probably the first-cast skin of the nymph. The outer layer appears to exercise a protective function, resisting strains and stresses and retarding evaporation of the body fluids. The fact that this transparent layer encloses the pigmented layer leads one to suspect that, like the jelly on a frog's egg, it may keep the egg warm by transmitting the sun's rays and retaining the heat into which they are transformed by the pigment.

Sometime before hatching, the period ranging from two to thirty days, the outer layer splits along the median line, exposing the pigmented layer, and the egg is thereafter very sensitive to weather (dry air particularly) and insecticides.

In the course of his experiments, Dr. Peterson found that the eggs were strongly affected by carbolic acid and by winter-strength lime-sulfur. He found that the carbolic acid appeared to soften the outer brittle layer in such a fashion that the egg soon shriveled, while the lime-sulfur appeared to harden it and to prevent hatching.

Table 1, taken from Dr. Peterson's work, will serve to show the effect of our common sprays upon the eggs and to indicate some substances worthy of further trial. The table is the summary of a large series of experiments. The percentage killed is

determined on the assumption that only that percentage of the total number would hatch which did hatch in the lots laid aside as checks and not treated with any substance in any way.

TABLE I

EFFECT OF SPRAYS ON APHIS EGGS

Materials Used	*Proportion Killed* *Per cent*
Lime-sulfur, 1-8 or 1-9	85-100
Lime-sulfur, 1-8 plus "Black Leaf 40," 1-500	97
"Black Leaf 40," 1-500 plus laundry soap, 2 lb. to 50 gal.	45
Laundry Soap, "Fels Naptha," 2 lb. to 50 gal.	5-33
"Scalecide," 1-15	25-65
"Mechling's Scale Oil," 1-19	79-90
Sodium Sulfocarbonate, 1-19	85
Sodium Chloride, 1 gm.* to 5 cc.** water	26-35
Sodium Hydroxide, 2 pt. to 98 cc. water	85-95
Crude Carbolic Acid (100%), 2 cc. to 98 cc. of solution, plus soap, 2 lb. to 50 gal. water	93-100

* gm.—gram.
** cc.—cubic centimeters.

Several important facts stand out in this table. The deadly quality of lime-sulfur is increased by the addition of 40 per cent nicotine. "Scalecide" is much less effective than lime-sulfur alone. "Scalecide," in which we are assured there is no carbolic acid, is much less effective than "Mechling's Scale Oil," in which, according to the makers, is found a percentage of carbolic acid. The great efficiency of a 2 per cent crude carbolic acid solution to which soap has been added is shown.

In the present stage of knowledge none of the substances can be recommended for the destruction of the eggs during dormancy, but the prospects for the development of such a spray seem encouraging. It can be said, however, that the study points to the idea that an application of the lime-sulfur and tobacco mixture at the green bud stage, even if not all of the eggs have hatched, is likely to give control by reason of the destruction of the unhatched eggs as well as the newly-hatched nymphs.

Destroying the Aphis in the Spring and Summer

In the spring, when first hatched, the young nymphs are very delicate, and, consequently, very susceptible to the effect of spraying mixtures. This led investigators to place reliance on spring and summer spraying as a means of controlling the

species. Unfortunately, several years of experience have demonstrated for the rosy louse, at least, that an attempt to control it after the foliage has been curled is sure to fail, and that an attempt to control it after the buds have really opened is almost certain to fail. The period in the spring when all three species can be brought under control has been thought to be very short, and was thought to extend from the hatching of the egg to the opening of the buds. The problem was further complicated by the fact that the eggs of the rosy aphis hatched, in some cases, coincidently with the opening of the early buds.

TABLE 2

EFFECT OF NICOTINE SPRAYS ON ROSY APHIS

Number of leaves	TREATMENT	Percentage living at end of experiment
2	Water only	100
2	"Black Leaf 40" (1 part) + water (900 parts)	60
2	"Black Leaf 40" (1 part) + water (900 parts) + soap (2 lbs. to 50 gal.)	10
2	"Black Leaf 40" (1 part) + water (700 parts) + soap (2 lbs. to 50 gal.)	1
2	"Black Leaf 40" (1 part) + water (500 parts)	10
2	"Black Leaf 40" (1 part) + water (500 parts) + soap (2 lbs. to 50 gal.)	0

In 1915 Parrott and Hodgkiss[3] recommended the delay of the usual winter-strength lime-sulfur, to which 40 per cent nicotine has been added at the rate of ¾ of a pint to 100 gallons, or about 1 part of nicotine to 1,000 parts of the spraying mixture, and the application of the mixture at the green bud stage. In 1915 one of our best apple growers almost completely failed to obtain control of aphis by adding nicotine to his pink-bud or cluster-cup spray at the rate of 1 to 800, while another claimed perfect control by adding the 40 per cent nicotine to the same spray at the rate of 1 to 500. To discover the strength of nicotine necessary for a complete kill of all ages of the rosy aphis, which has seemed more resistant to spraying solutions than either of the others, the experiment recorded in table 2 was made.

[3] Parrott, P. J., and Hodgkiss, H. E., 1915. Controlling plant lice in apple orchards. N. Y. (Geneva) Agr. Exp. Sta. Bul. 402.

Thus it appears that even when used with soap, which seems to give to it the maximum killing strength for aphis, 1 part of the nicotine to 500 parts of water was required to give a complete kill.

This suggested a number of points that needed clearing up, such as:

1. To what extent in comparison with other treatments does winter-strength lime-sulfur effect a control when applied during dormancy and before the eggs have hatched?
2. To what extent will winter-strength lime-sulfur applied at the green bud stage just after the lice hatch effect a control?
3. To what extent is the combination of winter-strength lime-sulfur and 40 per cent nicotine at the rate of 500 to 1 superior to a combination at the rate of 1,000 to 1?
4. To what extent would a winter-strength lime-sulfur treatment before the lice hatch, followed by an extra treatment of nicotine and soap just after the lice hatch, prove effective? This point was considered because of the fact that in 1915 the hatching of the rosy aphis was thought to have occurred after the buds opened.
5. To what extent would Scalecide (for which claims have been made) serve as a control?

In 1916 experiments were planned to answer these questions. They were located on the farm of Mr. John Barclay, of Cranbury. Mr. Barclay made all the applications according to schedule, and the quality of the spray coatings given by him could not be bettered. The trees were seven years old and very thrifty.

The plan of the experiments follows:

PLAN FOR APHIS EXPERIMENT IN THE APPLE ORCHARD OF MR. JOHN BARCLAY, NEAR CRANBURY, NEW JERSEY

No. 1	No. 2	No. 3	No. 4	No. 5. North	No. 6	No. 7	
.. x x x	x x x x	x x x x	x x x x	x x x x	x x	x x	{ Fall Pippin ½ { Greening ½
x x x x	x x x x	x x x x	x x x x	x x x x	x x	x x	Duchess
x x x x	x x x x	x x x x	x x x x	x x x x	x x	x x	Grimes
x x x x	x x x x	x x x x	x x x x	x x x x	x x	x x	McIntosh Red
x x x x	x x x x	x x x x	x x x x	x x x x	x x	x x	McIntosh Red
x x x x	x x x x	x x x x	x x x x	x x x x	x x	x x	Rome Beauty
x x x x	x x x x	x x x x	x x x x	x x x x	x x	x x	McIntosh Red
x x x x	x x x x	x x x x	x x x x	x x x x	x x	x x	Twenty Ounce
x x x x	x x x x	x x x x	x x x x	x x x x	x x	x x	Stayman Winesap
x x x x	x x x x	x x x x	x x x x	x x x x	x x	x x	Twenty Ounce
x x x x	x x x x	x x x x	x x x x	x x x x	x x	x x	Jonathan
x x x x	x x x x	x x x x	x x x x	x x x x South	x x	x x	Duchess
Lime-sulfur (1 to 9) during dormancy; "Black leaf 40" (1 to 1,000) + soap (2 lbs. to 50 gal.) when buds showed green	Lime-sulfur (1 to 9) during dormancy; lime-sulfur (1 to 9) + "Black leaf 40" (1 to 1,000) when buds showed green	Lime-sulfur (1 to 9) when the buds showed green	Lime-sulfur (1 to 9) + "Black Leaf 40" (1 to 500) when buds showed green	Lime-sulfur (1 to 9) + "Black Leaf 40" (1 to 1,000) when buds showed green	Scalecide during dormancy	Scalecide when buds showed green	

TABLE 3

EFFECT OF DIFFERENT TREATMENTS IN APHIS CONTROL EXPERIMENT

Plot No.	TREATMENT	Determination of Infestation, 4/20/1916		Determination of Infestation, 4/28/1916		Remarks
		Stayman Winesap		Twenty Ounce		
		No. of Buds	No. of Lice	No. of Buds	No. of Lice	
1	Lime-sulfur (1 to 9) during dormancy; "Black Leaf 40" (1 to 1,000) + soap (2 lbs. to 50 gal.) when the buds showed green	53	4	60	0	No injury
2	Lime-sulfur (1 to 9) during dormancy, followed by lime-sulfur (1 to 9) + "Black Leaf 40" (1 to 1,000) when buds showed green	57	6	60	1	No injury
3	Lime-sulfur (1 to 9) when buds showed green	54	58	80	8	No injury
4	Lime-sulfur (1 to 9) + "Black Leaf 40" (1 to 500) when the buds showed green	101	6	60	0	No injury
5	Lime-sulfur (1 to 9) + "Black Leaf 40" (1 to 1,000) when the buds showed green	100	53	60	7	No injury
6	Scalecide (1 to 15) during dormancy	75	14	60	2	Badly scorched
7	Scalecide (1 to 15) when the buds showed green	76	5	60	0	Badly scorched; 50 per cent killed

TABLE 4

EFFECT OF DIFFERENT TREATMENTS IN APHIS CONTROL EXPERIMENT

Plot No.	TREATMENT	Determination of Infestation, 4/20/1916		Determination of Infestation, 4/28/1916		Remarks
		Grimes Golden		McIntosh Red		
		No. of Buds	No. of Lice	No. of Buds	No. of Lice	
1	Lime-sulfur (1 to 9) during dormancy; "Black Leaf 40" (1 to 1,000) + soap (2 lbs. to 50 gal.) when buds showed green	68	1	100	0	No injury
2	Lime-sulfur (1 to 9) during dormancy; lime-sulfur (1 to 9) + "Black Leaf 40" (1 to 1,000) when buds showed green	65	4	100	7	No injury
3	Lime-sulfur (1 to 9) when the buds showed green	86	88	100	150	No injury
4	Lime-sulfur (1 to 9) + "Black Leaf 40" (1 to 500) when buds showed green	78	5	100	0	No injury
5	Lime-sulfur (1 to 9) + "Black Leaf 40" (1 to 1,000) when the buds showed green	71	87	100	9	No injury
6	Scalecide (1 to 15) while the buds were dormant	71	8	100	13	Badly scorched
7	Scalecide (1 to 15) when the buds showed green	67	3	100	1	Badly scorched; 50 per cent killed

For the purpose of making a comparison of the results given in the preceding tables easy, table 5 is submitted.

TABLE 5

SUMMARY OF RESULTS IN APHIS CONTROL EXPERIMENT

Plot Numbers	TREATMENT	Total number of buds examined	Total number of aphis found	Number of aphis per 100 buds
1 & 1	Lime-sulfur (1 to 9) during dormancy; "Black Leaf 40" (1 to 1,000) + soap (2 lbs. to 50 gal.) when buds showed green	281	5	1.7
2 & 2	Lime-sulfur (1 to 9) during dormancy; lime-sulfur (1 to 9) + "Black Leaf 40" (1 to 1,000) when buds showed green	282	18	6.3
3 & 3	Lime-sulfur (1 to 9) when the buds showed green	320	304	95.
4 & 4	Lime-sulfur (1 to 9) + "Black Leaf 40" (1 to 500) when buds showed green	339	11	3.2
5 & 5	Lime-sulfur (1 to 9) + "Black Leaf 40" (1 to 1,000) when buds showed green	331	156	47.1
6 & 6	Scalecide (1 to 15) while buds were dormant	306	37	12.
7 & 7	Scalecide (1 to 15) when the buds showed green	303	9	2.9

Note.—Unsprayed trees showed average of 600 aphis per 100 buds.
A large block of trees of the same age and variety in the same orchard were sprayed with lime-sulfur (1 to 9) during dormancy. These trees showed an average of 6 aphis to 100 buds.

Lime-sulfur when applied during dormancy seems greatly to reduce the aphis, causing the number to fall from about 600 aphis per 100 buds to 6 aphis to 100 buds. Lime-sulfur when applied in the green-bud stage, after the hatching of the lice, made a much smaller reduction, causing the number to fall from 600 per 100 buds to about 95 per 100 buds.

The combination of winter-strength lime-sulfur and "Black Leaf 40" at the rate of 500 to 1 is more effective than the combination at the rate of 1,000 to 1, as shown by the fact that the former reduces the aphis to 3 individuals to each 100 buds while the latter left 47 lice to each 100 buds.

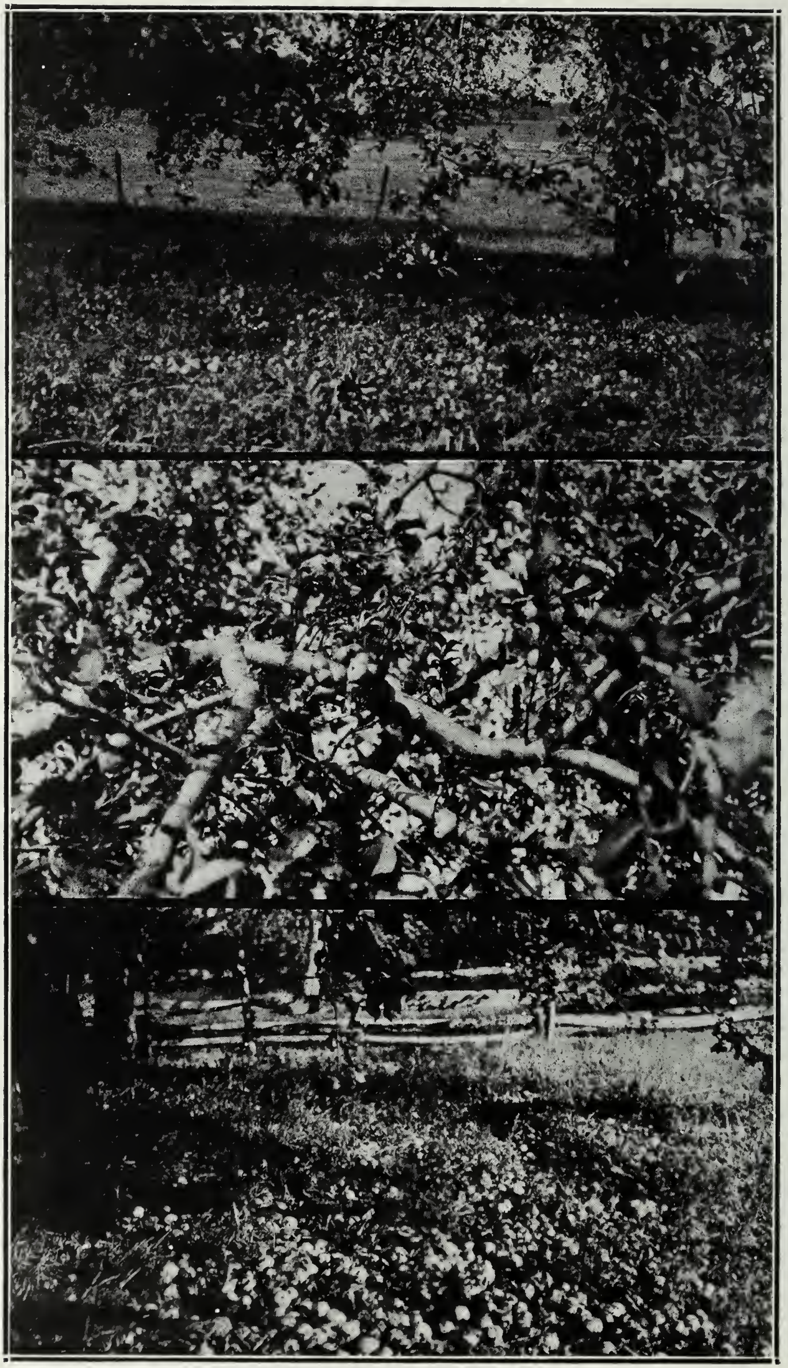


Fig. 4. Trees not properly sprayed for aphis; note small apples and dropped apples

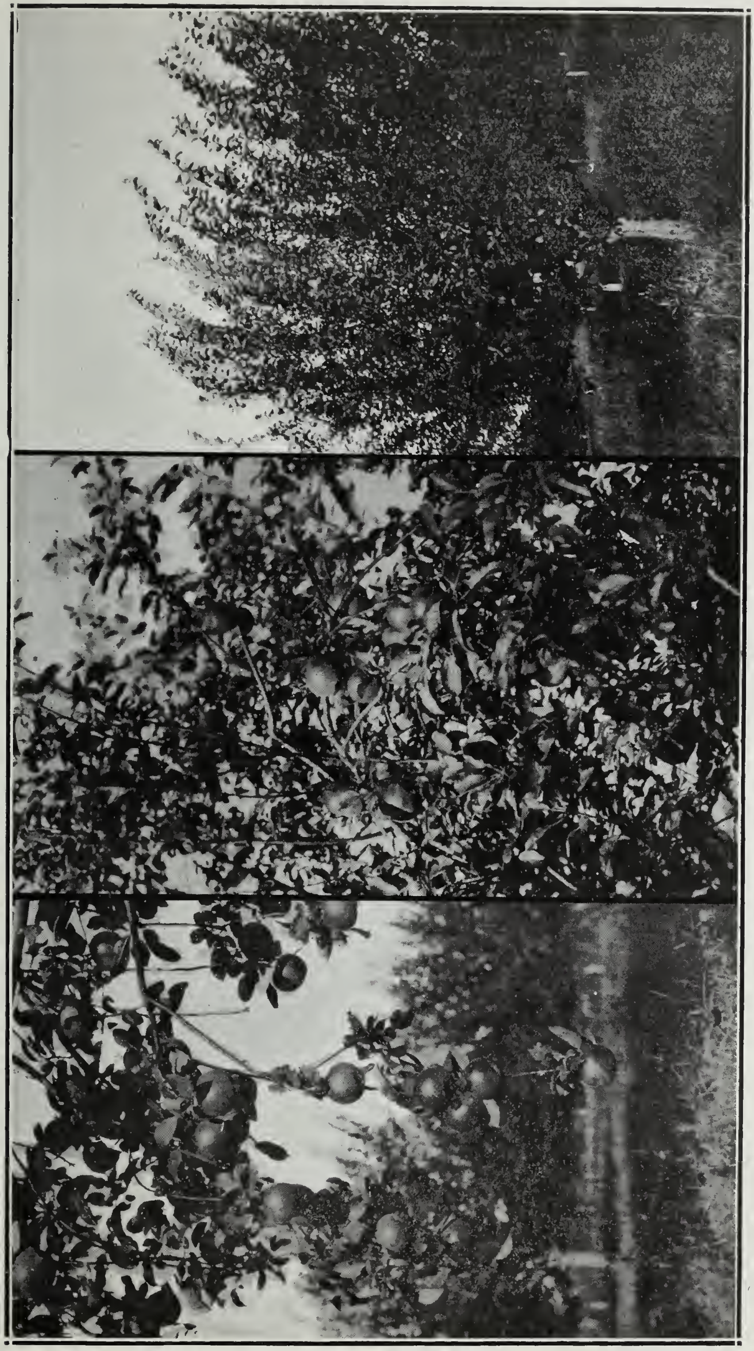


Fig. 5. Trees properly sprayed for aphis; note fine foliage, large fruit, and absence of dropped apples

The application of winter-strength lime-sulfur during dormancy followed by "Black Leaf 40" and soap at the green-bud stage just after the lice had hatched seemed very effective, leaving only 2 lice to each 100 buds.

Scalecide when used during dormancy scorched the buds, and when used during the green-bud stage, after the lice hatched, killed 50 per cent of the buds. In both cases it reduced the number of lice.

Thus it appears that until methods of destroying the egg during dormancy are better developed, the best aphis treatment from the standpoint of labor, safety and efficiency is an application of winter-strength lime-sulfur, to which 40 per cent nicotine has been added at the rate of 1 to 500 at the green-bud stage. Under this system no winter-strength lime-sulfur or soluble-oil treatment is ordinarily required, and the normal labor of orchard procedure increased only slightly.

The one question remaining in the writer's mind after the experiment of 1916 was whether, if the advancement of the trees should compel treatment before hatching, the eggs would not later hatch a damaging brood of lice. The laboratory work of Dr. Peterson in 1917, already mentioned, indicated that the unhatched eggs would be destroyed. Fortunately, there was opportunity to try this out on a field scale.

When the oat aphis appeared on the buds Mr. Barclay sprayed a block of trees with winter-strength lime-sulfur to which "Black Leaf 40" had been added at the rate of 1 to 500. At the same time an adjacent block was sprayed with Scalecide (1 to 15). On the first block practically no aphis appeared thereafter, and trees were almost entirely free from aphis work. On the second block, although only a few living aphis could be found on the afternoon of the day when the spray was applied, colonies of the rosy louse appeared later, curled the foliage and did much damage to the fruit.

No one knows how many aphis per 100 buds may be left unhurt and the crop escape injury. As a matter of fact, the number which may safely be left this year might next year be sufficient to produce large damage, so much depends upon the weather and the natural enemies of the lice. The only safe plan to follow is to kill as many of the lice as possible. *This means the application of the recommended treatment with the utmost thoroughness, for neither lice nor eggs will be destroyed unless they are well covered.*

Assuming that the best practicable treatment for aphis, with our present knowledge, is the application of lime-sulfur and

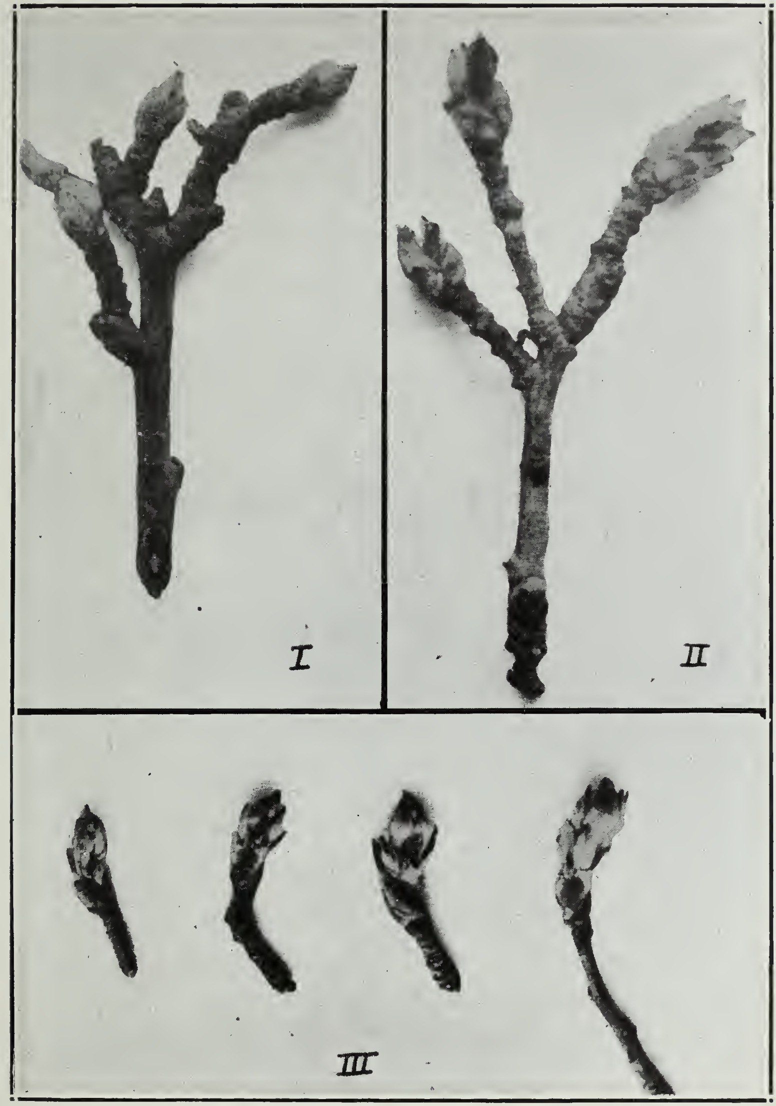


Fig. 6. Stages in bud development. The best time to spray for aphis is the period from *I* to *II*; *III* illustrates later development

nicotine in such a fashion that all the lice and lice eggs are coated, the question of the time of application becomes exceedingly important. It seems clear from the laboratory and field studies that the green-bud stage is the best, because at that time the maximum number of lice will have hatched and are without shelter, and the unhatched eggs are most susceptible.

The term "green-bud stage" is rather elastic and somewhat difficult to define. When the bud scales first separate at the tip the parts exposed are silvery and only slightly green. The silvery look is due to the presence of a heavy pubescence on the structures exposed. In the course of a very few days this silvery look gives way to a decided green as the edges of the leaves begin to project. Treatment should be completed by the time the latter stage has been reached, for the next stage, which may follow within a single warm day and night, and shows the young leaves projecting from the buds like squirrel ears, is not only liable to be injured by the treatment, but offers shelter to the lice.

CONCLUSIONS

1. Three species of plant lice—green apple aphis, the rosy apple aphis and the oat aphis, especially the first two—attack the foliage and fruit of apple in New Jersey and are capable under favorable conditions of destroying a large percentage of the crop.

2. All species winter over on the water sprouts, twigs, and smaller branches of the apple trees as small shining black oval eggs just large enough to be seen with the naked eye.

3. While it is not possible to forecast an outbreak with certainty, even when the eggs are on the trees, because of the effect of weather and natural enemies, preparations should be made for treatment as a matter of insurance if the eggs are present.

4. Control by destruction of returning migrants and egg-laying individuals in the fall is probably impracticable, because of the number of sprayings that would be necessary.

5. The probability of developing a method of control by destroying the eggs during dormancy seems strong, but in the present state of knowledge it should not be depended on.

6. Control by destroying the aphis after the leaves are pretty well unfolded is likely to prove impracticable because of the shelter which the leaves afford the lice.

7. The most practicable treatment for aphis control is the application of winter-strength lime-sulfur to which 40 per cent

nicotine has been added at the rate of 1 to 500, during the green-bud stage, because the maximum number of lice will be hatched at that time (and will be killed by the nicotine) and the unhatched eggs will be in their most sensitive state (and will be destroyed by the mixture).

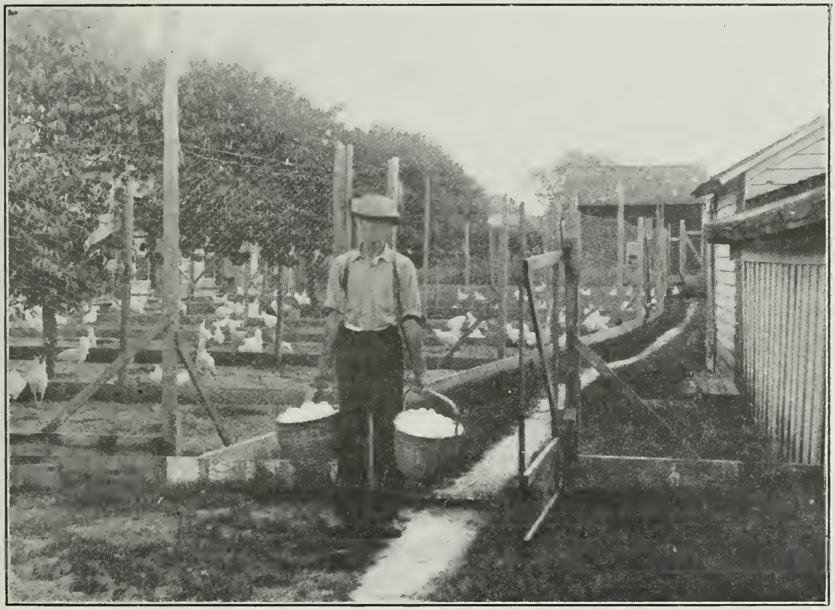
8. The green-bud stage is that stage of development which just precedes the escape of the new leaves from the flower buds in such a fashion as to resemble squirrel ears.

NEW JERSEY

AGRICULTURAL EXPERIMENT STATIONS

BULLETIN 329

(Farm Management Bulletin 4)



On a Commercial Poultry Plant in New Jersey

PROFITS AND FACTORS INFLUENCING PROFITS ON 150 POULTRY FARMS IN NEW JERSEY

NEW BRUNSWICK, N. J.

NEW JERSEY AGRICULTURAL EXPERIMENT STATIONS*

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TABLE OF CONTENTS

ILLUSTRATIONS

PLATES

TEXT FIGURES

NEW JERSEY

AGRICULTURAL EXPERIMENT STATIONS

BULLETIN 329

March 15, 1918

Profits and Factors Influencing Profits on 150 Poultry Farms in New Jersey

Frank App

Allen G. Waller

Harry R. Lewis

Introduction

In recent years there has been a stimulation of interest in the business side of farming. Farm management departments have been making farm surveys, but most of these were made from dairy and general farms. Farm types, as such, have not been the subject of much investigation. This is the fourth publication of the New Jersey Agricultural Experiment Station on farm types. New Jersey has very diverse interests and the types of farming in most cases are clearly defined. This affords an excellent opportunity to study different phases of agriculture and their requirements for success.

This is a study of 150 poultry farms whose receipts and expenses were almost exclusively from and for poultry, for the year November 1, 1915, to November 1, 1916. Of this number 116 records were obtained from the Vineland area in Cumberland County, 22 from the vicinity of Lakewood and 12 from the northwestern part of Sussex County, along the Delaware River.

Though these farms were not all located in one continuous area, the methods, buildings, breed of chickens and the rations used on the farms in the different areas, were about the same. This allows the combining of farms not in one continuous

locality without giving results that are misleading or not representative of the business.

The Poultry Industry

Poultry will become more prominent in our agriculture and on the individual farm as our population increases. The total number of fowls in the United States reported by the thirteenth census (1910) was 295,880,190, an increase of 17 per cent above the number reported for the twelfth census (1900). This is an average of about 3 fowls per man, woman and child. The production of eggs by these fowls was reported as 1,293,662,000 dozen, an increase of 23 per cent over that of the twelfth census. The population for this period increased but 21 per cent. Thus our hens appear to be laying more eggs and probably are receiving more care. This would be a production of about 5.3 dozen per fowl, or about 14 dozen per individual. However, all of these eggs are not consumed; some are needed for hatching, and 5,207,151 dozen of these were exported. During this period 238,650 dozen were imported. In 1915, the United States exported 20,784,424 dozen eggs, while the imports for the same year were 3,046,631 dozen. Thus we are increasing our exports over imports annually.

It was estimated[1] that in 1914 the total value of eggs produced in the United States was $350,000,000. Add to this the value of fowls raised and the sum would be about $570,000,000. This exceeded the value of our oats crop, and nearly equaled the value of the wheat crop for 1914.

In 1909 and 1910 New Jersey sold poultry products valued at $4,666,000, or 8 per cent of the value of all agricultural products. The United States sold $256,042,000, or 3 per cent of the total value of agricultural products. Thus New Jersey has a relatively more important poultry industry than most of the other states. Of this amount 54 per cent was received from eggs and 46 per cent from fowls.

From this it is evident that the poultry industry tends to develop around large centers of population. This is due to the better facilities for selling eggs and poultry. Climate may have some effect upon the industry, but probably not so much as good markets for chickens and eggs. The southern states show a

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[1] U. S. Dept. Agr. Yearbook 1912, p. 19.

relatively less important poultry industry. Two factors affect the poultry industry in the South: first, large markets are not at hand and second, the climate is too warm for poultry.

New Jersey, with a population of about 3,000,000 people, produced only 13,630,302 dozen eggs in 1909–10, or less than 5 dozen per individual. The state sold but 2,130,591 fowls or less than one per individual. This does not account for the poultry raised in the villages and suburban communities, the latter of which have many small poultry flocks within city limits. Prof. H. R. Lewis made a thorough survey of the poultry industry in New Brunswick, and found 14,000 birds kept in city back yards. The population at that time was 27,000 inhabitants. Prof. Lewis estimates the number of fowls in the state to be as follows:

Adult fowls on farms, 1914,	1,900,000
Adult fowls in cities and suburban communities, 1914,	1,000,000
Total for New Jersey, 1914,	2,900,000

There were about 50 chickens per farm on the farms where chickens were kept in 1910. Thus the average farm flock is small. These birds will hunt a large part of their own living by foraging for bugs, lost grain and like products. But little labor is given such a flock and this is frequently done by the farmer's wife and children. Consequently, the major portion of the poultry industry is sustained by cheap feed and labor. Looking at the industry from this viewpoint, it does not appear attractive as a specialized type of farming. But let us consider the results obtained from the common method of raising and caring for poultry on the average farm, and the results obtained when the proper care and attention are given to it. The average production of eggs per fowl for the United States was 5.3 dozen in 1910. The average production for these 150 poultry farms was 109, or 70 per cent greater. With eggs selling at 34 cents per dozen (the average for 1916) the increase per bird on these farms would be $1.29. This should pay for the increase in labor and feed, and still leave a margin in favor of proper care for the poultry. Where market facilities are not so good and poultry products low in value, then specialization might not be profitable; there are certain conditions necessary for specialization in order to make it successful.

Advantages of New Jersey as a Poultry State

Markets

The value of poultry in New Jersey is high in proportion to its other agricultural products. While in 1910 New Jersey had 8 per cent of its agricultural wealth in poultry, the United States had but 3 per cent. This may indicate that the state has certain advantages not enjoyed by all localities.

The first great advantage in New Jersey is its markets, which are unequalled by most states, and unexcelled by any other. The production in the state is not sufficient to supply its own people, while the great markets of New York and Philadelphia are directly at its doors. This is quite an advantage, for poultry products, in order to command top prices, must be produced close to the consumer. It is true that eggs and poultry meat are shipped long distances, but they are not fresh when they reach their destination, and consequently must be sold at a lower price. The reader can verify these facts by examining table 1, which shows that the prices of poultry products are highest around the centers of population. In only three states east of the Mississippi River—Massachusetts, Rhode Island and Connecticut—was the price of eggs in 1910 higher than in New Jersey. Of the western states, Nevada, Washington and Montana reported higher prices than New Jersey. That farmers in these states, so far from centers of population, should receive more is largely due to the fact that they do not recognize the value of poultry, and consequently the industry is still in an undeveloped state, leaving a scarcity of eggs. Unlike hogs, which follow the states which produce the most corn, chickens follow more closely the centers of population. Pork can be more easily shipped than eggs. Farmers in corn states, located far from the markets, often find it cheaper to ship their corn to market in the form of pork to save freight.

Before the raising of any product can be made a successful enterprise, it is necessary to have good markets. New Jersey has this essential well developed.

Table I

Relative Importance of the Poultry Industry in Various States

GEOGRAPHIC SECTION	STATE	† Eggs Number Produced	† Eggs Value	† Chickens Number Produced	† Chickens Value	Per Cent of Total Agricultural Products‡	Price Per Dozen Eggs§
New England,		51,487,518	$14,167,103	10,143,637	$6,712,323	......	......
	Maine,	14,052,820	3,568,100	2,348,403	1,313,160	6	$0.27
	New Hampshire,	6,936,520	1,889,954	1,245,634	785,091	6	.29
	Vermont,	6,580,466	1,603,925	1,154,879	683,785	3	.27
	Massachusetts,	13,305,540	4,026,346	2,974,619	2,232,653	7	.34
	Rhode Island,	2,728,891	800,094	556,598	445,414	12	.34
	Connecticut,	7,883,281	2,278,684	1,863,504	1,252,220	6	.33
Middle Atlantic,		152,222,031	35,242,048	33,689,001	19,941,206	......	......
	New York,	67,688,879	16,000,173	12,701,540	7,634,267	4	.27
	New Jersey,	13,630,302	3,584,157	4,453,830	3,533,844	8	.29
	Pennsylvania,	70,902,850	15,657,718	16,533,631	8,773,095	6	.25
East North Central,		370,965,805	71,147,639	96,463,041	45,152,966	......	......
	Ohio,	96,259,005	18,842,241	22,112,259	10,377,777	5	.22
	Indiana,	76,734,210	14,525,977	21,895,510	10,181,036	4	.20
	Illinois,	93,554,983	17,698,603	30,630,613	14,584,010	3	.20
	Michigan,	56,176,525	11,002,435	11,864,965	5,704,602	4	.21
	Wisconsin,	48,241,082	9,078,383	9,959,694	4,305,541	3	.21
West North Central,		413,838,848	71,861,845	114,871,313	48,609,932	......	......
	Minnesota,	50,413,375	9,151,211	10,933,411	4,345,534	3	.20
	Iowa,	103,273,505	18,098,752	28,388,446	13,171,819	3	.19
	Missouri,	104,185,119	18,025,250	29,880,192	13,644,244	4	.18
	North Dakota,	15,194,736	2,675,931	3,365,998	1,273,984	*	.21
	South Dakota,	22,396,021	3,791,973	5,462,171	2,079,797	2	.19
	Nebraska,	42,769,550	7,282,024	14,073,412	5,405,328	2	.18
	Kansas,	75,606,542	12,836,704	22,767,683	8,689,226	3	.18
South Atlantic,		125,634,154	24,508,880	64,779,063	22,427,518	......	......
	Delaware,	4,224,300	920,139	1,476,469	792,429	8	.24
	Maryland,	14,464,013	3,012,931	5,568,745	2,818,680	6	.22
	Dis. of Columbia,	50,689	14,908	14,834	8,647	......	......
	Virginia,	33,544,512	6,577,152	15,518,010	5,853,828	5	.21
	West Virginia,	18,074,410	3,464,309	5,115,305	2,065,924	5	.21
	North Carolina,	21,838,671	3,946,412	14,048,470	4,148,542	2	.19
	South Carolina,	9,722,160	1,902,993	7,865,401	2,274,618	*	.21
	Georgia,	18,162,972	3,469,327	13,076,103	3,608,122	*	.21
	Florida,	5,552,427	1,200,709	2,095,726	856,728	2	.24
East South Central,		117,141,106	20,210,445	55,402,822	17,366,246	......	......
	Kentucky,	40,463,030	6,944,315	17,578,788	6,335,656	3	.18
	Tennessee,	39,352,433	6,793,640	16,282,596	5,398,647	3	.18
	Alabama,	19,626,126	3,321,033	11,089,870	2,818,365	1	.18
	Mississippi,	17,699,517	3,151,457	10,451,568	2,813,578	1	.19
West South Central,		136,787,145	21,829,363	50,796,202	15,187,413	......	......
	Arkansas,	23,608,739	3,891,298	9,420,184	2,500,045	2	.18
	Louisiana,	12,176,725	2,034,088	5,255,223	1,611,739	1	.19
	Oklahoma,	38,521,787	6,317,863	13,680,484	4,532,234	2	.18
	Texas,	62,479,894	9,586,114	22,440,311	6,543,395	1	.17
Mountain,		28,518,888	6,875,523	6,912,613	3,436,498	......	......
	Montana,	4,706,178	1,262,572	1,116,690	621,539	1	.33
	Idaho,	5,088,908	1,213,724	1,298,067	628,670	1	.29
	Wyoming,	1,587,433	380,509	389,962	195,697	*	.29
	Colorado,	8,579,743	1,968,472	2,149,556	1,106,197	2	.26
	New Mexico,	2,273,320	522,029	675,022	266,452	1	.27
	Arizona,	1,311,134	398,995	288,771	166,099	3	.34
	Utah,	4,240,007	907,330	829,505	351,937	2	.24
	Nevada,	732,165	221,892	165,040	99,907	1	.38
Pacific,		60,790,277	15,315,134	12,592,432	6,556,754	......	......
	Washington,	14,326,464	3,749,599	3,186,743	1,604,056	3	.31
	Oregon,	10,555,840	2,582,331	2,309,350	1,231,954	3	.29
	California,	35,907,973	8,983,204	7,096,339	3,720,744	4	.29

* Less than 1 per cent.
† Rpt. 13th U. S. Census, 1910, Vol. 5, p. 512–515.
‡ Field Agents' Handbook of Agricultural Statistics. U. S. Dept. Agri. Bur. Crop Statistics (1914).
‡ Warren, G. F., 1917, Farm Management, p. 576–577.

Climate

Poultry does best in a temperate climate, though it is raised under a wide range of climatic conditions. Extreme temperatures should be avoided. A dry atmosphere is preferable to humid conditions, since great humidity is apt to cause sickness and disease among the birds. These qualifications are found in New Jersey, although portions along the coast subject to heavy and frequent fogs are not so well adapted.

Soils

The southern half of New Jersey lies in the Coastal Plain soil province. Since all of the soils in this region were laid down under water, much of it is sandy or gravelly. This provides a dry well drained soil, that warms up quickly and allows filth to leach away readily, qualities which are very desirable for poultry production. The northern half of the state is rolling, and largely covered with glacial soils. This topography allows good soil drainage with sufficient elevation to prevent high humidity and fogs. Thus the whole state has soil conditions favorable for poultry raising. The Vineland and Lakewood areas are located on sandy soils of level topography, while the Sussex area is located on glaciated soils of a rolling to hilly topography.

Established Business

Certain portions of New Jersey have a well established poultry farm business. For example, the Vineland section consists of one continuous poultry section, where one poultry farm is adjacent to others of the same type. Outside of Petaluna, California, no other area is reported in the United States where poultry farming has been developed to so high a degree. For the beginner who wishes to learn the poultry business, this is a marked advantage. Observation from the adjacent farms and communication with the neighbors are of great assistance in learning the business. Besides, in a successful business already established, accurate information concerning the advantages of a locality is available.

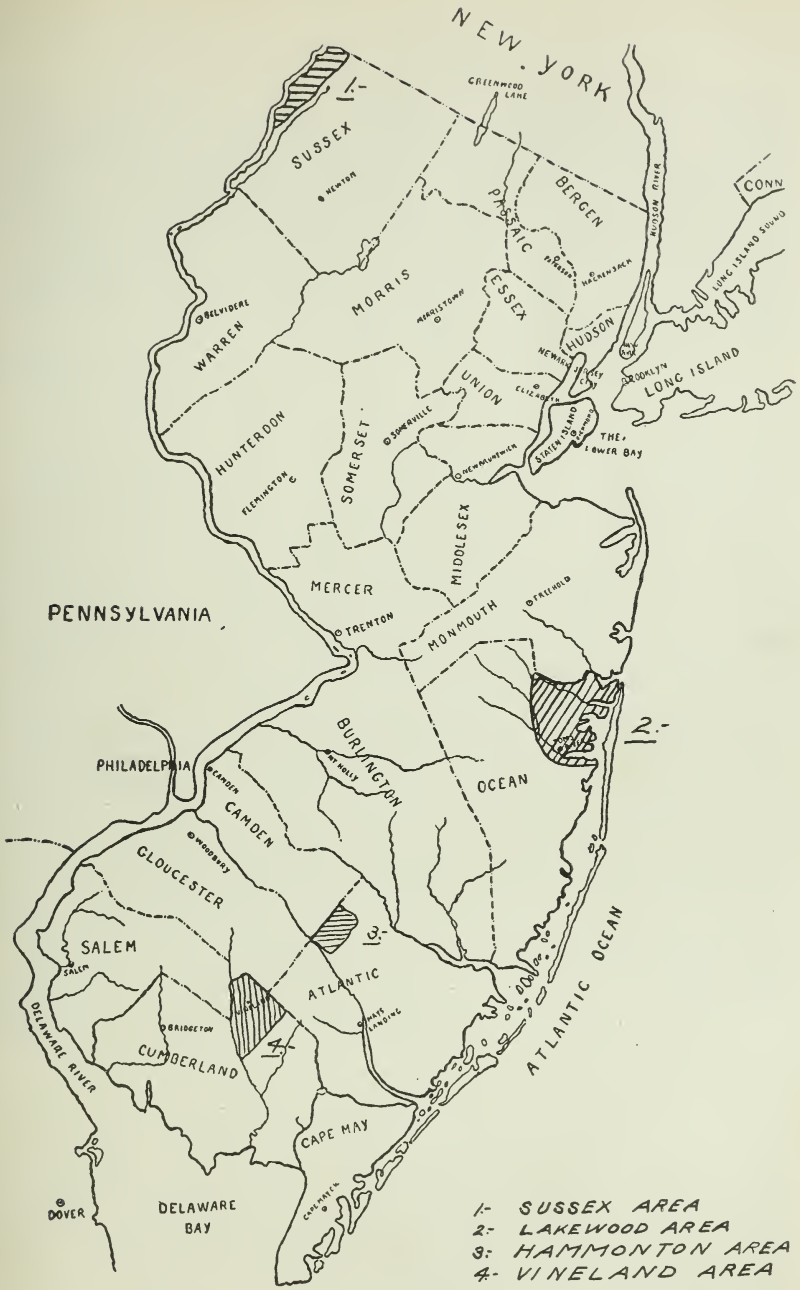

Fig. 1. Map of New Jersey, showing Areas in which the Survey was Made.

Description of the Poultry Areas in New Jersey

Vineland

The Vineland poultry area covers a rectangular tract in Cumberland County about five miles wide and seven miles long,

including the borough of Vineland which is about one mile square. With North Vineland as its northern boundary, the tract extends seven miles south almost to where Lincoln Avenue joins the Main Road. The western boundary can be taken as Mill Road and the eastern as a very short distance east of Brewster Road. It is located 35 miles south from Philadelphia and 125 miles from New York City.

Transportation facilities are excellent, no poultry farm being over 2 miles from the shipping point. The Central Railroad of New Jersey (Bridgeton Branch) crosses the area from east to west, while the Cape May division of the Pennsylvania Railroad passes through the district from north to south, both railroads having stations at Vineland. In addition to the two railroads, there is a trolley line from Vineland to Millville, which runs an express car twice a day. With these facilities many of the poultrymen are farming with no horses. They take the eggs to the trolley express, which carries them to Vineland for five cents a case, where the express companies receive them and ship to their destination. From the map (fig. 1) it is readily seen that the larger and more extensive quarter of the poultry area has settled along the trolley or within easy reach of it. The roads in this area are largely gravel, and are very good.

The topography is level with but few slight depressions where poultry is noticeably absent. The soil in this area is one of its best features, considered from the standpoint of poultry raising, being light, very sandy in some portions, with considerable gravel in most places. It is well drained, making it possible to keep poultry on the same ground year after year without much danger from disease, as there might be on heavier, clayey soils. The soil is probably the largest single factor that allows successful intensive poultry farming here. As the soil is light and sandy, it also warms up early in the season and allows a long range period for the birds. This is a decided advantage, as it lessens the feed cost considerably.

The climate of Vineland is another feature in favor of the poultry business. It has moderate winters with slight snowfalls which usually last only a few days at a time. Both winters

and summers are moderate, being neither excessively cold nor excessively warm, a condition especially desirable for poultry business. Although the area is not high above sea-level, and is not far distant from the ocean and bay, fogs are not troublesome.

Excellent shipping facilities, nearness to Philadelphia and New York markets, good roads, light well drained soils, and mild climate make the Vineland area especially adapted to poultry raising.

Lakewood

The Lakewood area, with Lakewood as its center, is located in Ocean County, 63 miles from New York City, and about 13 miles from the shore resorts. For shipping facilities it has the Central Railroad of New Jersey running directly to New York. The area is traversed by good gravel roads.

The poultry industry of this area is not quite so intensive as in the Vineland area, the farms being larger and more scattered.

The topography of Lakewood is fairly level and the soils are light, similar to those of Vineland, except that they are somewhat more sandy. The area is in the celebrated pine belt of New Jersey and is marked by the characteristic growth of pines, which help protect and moderate the naturally mild winters. The climate is quite similar to that of Vineland.

Altogether, the Lakewood area has practically the same good features for the poultry business as Vineland, i. e., light soils, nearness to market, good roads and a mild climate.

Sussex

The Sussex poultry area differs considerably from the Vineland and Lakewood areas. It is located in the northwestern part of Sussex County in the hills and valley along the Delaware River. Transportation facilities are poor, the country roads being very rough, and shipping points—Port Jervis and Branchville—from three to seven miles away. Branchville is 70 miles from New York City on the Delaware, Lackawanna and Western Railroad, while Port Jervis is 80 miles from New York City on the Erie Railroad.

The topography is exceedingly rough for New Jersey farm land, and the soil is mainly silt loam or stony loam. The section has mild summers, but severe winters.

Thus the Sussex poultry area has the disadvantage from the standpoint of raising poultry, of severe winters, poor transportation and heavier loam soils. Drainage is provided by the natural slope of the land.

The poultry farming in this area is not quite so intensive as either at Lakewood or at Vineland, and some crops are raised along with the poultry.

POULTRY ASSOCIATIONS

In each area surveyed poultry associations are active in promoting the interests of the industry, and they gave valuable aid in securing the data through the hearty co-operation of their members. The New Jersey State Poultry Association now has a paid-in membership of between 1,000 and 1,100. The four poultry associations in the sections surveyed furnish 277, or over one-fourth of the total state membership. Each local association has a complete constitution and set of by-laws. The objects of all are the same, but the various associations vary considerably in the degree of activity which they maintain.

Vineland

The Vineland Poultry Association is an organization started eight years ago with three objects in view.

1. *Educational.*

In addition to a business meeting once a month, the association arranges a series of educational lectures and demonstrations. This is in the hands of a special educational committee.

At these meetings members of the poultry department staff of the New Jersey Agricultural Experiment Station and other well known poultry authorities are secured to discuss the problems and possibilities of the poultry business. The meetings are generally held through the winter when the poultrymen have more leisure. During the past winter, 1916–1917, the association held six of these educational meetings with an average attendance of about two hundred.

2. *Commercial.*

Acting as an approved member of the New Jersey State Poultry Association, the Vineland Poultry Association can buy feed and supplies co-operatively through the State Poultry Association directly from wholesale grain houses in the West. The Vineland Association has only recently begun to purchase feed in this way, but it has possibilities of being an economical method of purchasing for the members, as well as a means of securing grains of the best quality.

The question of marketing poultry products, especially eggs, co-operatively, is being agitated at the present time by members of the association and it will no doubt be taken up by the organization shortly. Certainly with the proper organization, special recognition could be obtained from the large egg markets, of the uniform, high-quality white-shelled eggs produced in the Vineland district. This would mean additional profits to the members, as well as advertisement for the area.

3. *Legislation.*

Any legislative measure that can be of value to promote or protect poultry interests is forwarded by the state as well as local poultry associations. This applies to local and state-wide laws.

In addition to these three distinctly business objects, the association aims to perform a social function to add interest both inside and outside its ranks. Twice a year it holds a "poultryman's frolic" which is attended by five to six hundred people and gives a general good time to all present.

The Vineland Poultry Association started out with 40 members and has now developed to 160 paid-in members to the state association. Its annual dues are $1.00, including 75 cents for its own running expenses and 25 cents for the dues which the state association requires of all members.

Thus the Vineland Poultry Association is growing and becoming a factor in the community life of the area. As it develops it is becoming of greater value to its members as an educational, commercial, legislative and social factor.

Hammonton

The Hammonton Poultry Association is one of the oldest poultry organizations in New Jersey, and was especially large

when the broiler industry of South Jersey was at its height. At present it has 25 paid-in members to the State Poultry Association. One of its chief activities includes the management of a supply store where its members purchase all their feed.

Lakewood

The Lakewood Poultry Association has been organized four years and has made rapid growth, having 64 paid-in members. It is very active especially with regard to the co-operative purchasing of feed and supplies. A separate warehouse has been secured and the project seems to be progressing satisfactorily.

Tri-State

The Tri-State Poultry Association includes the poultrymen in the northwestern part (Montague Township) of Sussex County. It also has a few members from New York State and Pennsylvania. Organized two years ago, it now has a paid-in membership of 28.

FLOCK PRACTICE

The general methods of flock practice on these commercial plants can be described as fairly uniform. Although there are variations according to the individual poultryman's ideas, these variations are usually on the minor details of flock management. The general practices of the Vineland area are given in the following paragraphs.

Breeders

A certain number of the best yearlings are kept over every winter as breeders to furnish hatching eggs. These birds are selected according to their laying ability, and general vigor or vitality, as well as type. During the last two years, the practice has grown of hatching in February, and using pullets from the February hatching as breeders the following winter. This method is being practiced by a greater number of poultrymen each year and seems to work out very satisfactorily, as the February birds are more easily raised, and the cockerels from this early hatch can be sold when broiler size at a profitable price. The birds to be used as breeders are mated up usually from the

first of January to the fifteenth, which allows the saving of hatching eggs the last of January. The production from these breeders will vary from 30 to 70 per cent by April first. This production may be reasonably expected, although it may fall below or possibly may rise above the averages given, according to the individual poultryman's good fortune in careful selection of birds and general skill in handling them, which includes the prevention of disease.

Hatching Eggs

After the hatching eggs are produced, they are sorted over carefully, and the odd-shaped, extra large and tinted eggs taken out, thus leaving medium-sized, uniform-shaped eggs to be used for hatching. In this selection or culling out, as many as 20 to 25 per cent of the total number may be removed.

Incubation

The majority of the poultrymen maintain just enough of incubator capacity to do their own hatching. Of the 150 farms in this survey, there were 9 that did custom hatching, and 35 that were selling day-old chicks, while 13 were buying day-old chicks.

The most common type of incubator was one with a capacity of from 360 to 400 eggs, this size representing 41.7 per cent of the total incubator capacity on the 150 farms, while 53.7 per cent of the total capacity was included in incubators holding less than 500 eggs. There were 28 incubators having a capacity of 1,000 eggs or over, the smallest holding 60 eggs and the largest 13,600 eggs.

Both oil and gas are used as fuel for the small-sized incubators, gas being the more expensive but usually giving less trouble in regulating and watching. Coal is used with all the larger-sized incubators.

Some of the larger poultry plants have separate cellars for incubation, usually with a feed room built over them. But on the larger number the hatching is done in the cellar of the dwelling house.

Brooding

After the chicks are hatched they are left in the incubator one or two days and then placed in brooders. Right at this point begins what might be termed the first culling, as the weak and deformed chicks are not transferred from incubator to brooder. This is a critical period in the raising of the chicks. The small chicks are fed four times a day for the first week, three times a day the next two weeks, and after that twice a day. Milk mash is quite commonly used to start them on, and a scratch feed of home mixture or commercial manufacture is kept in hoppers before them at all times, as well as charcoal, oyster shells and grit.

There are various types of brooders in use. The most common type on the older poultry plants is the long brooder house, 14 to 20 feet in width and the length determined by the number of chicks to be brooded. The chick boxes are usually about 3 feet square with a 2-foot hover, and have a capacity of about 85 chicks. Heat is usually furnished by hot water pipes in this particular type of brooder.

Colony brooder houses are being used largely on the newer poultry plants and are giving satisfactory results. The colony house itself is usually 6 by 8, 6 by 10 or 8 by 10 feet in size. By installing a coal stove brooder and hover in these houses, from 300 to 500 chicks are cared for.

The February and early March chicks are brooded for eight to ten weeks, while the chicks hatched later are brooded for six to eight weeks. Then the chicks are placed in colony houses and put on range where they have free range on green forage such as young rye or wheat, alfalfa or rape.

During the entire brooding period the more progressive poultrymen continue a rigid culling out of the chicks that lack vigor or are undesirable in any way. When about four weeks old, or as soon as they can be distinguished, the young cockerels are separated from the rest of the flock. The birds hatched in February or March are often raised to broiler size (¾ to 1 pound), but those hatched in April and May are sold at about five weeks of age.

When the long brooder houses are used, the poultrymen transfer the chickens to separate colony houses that usually carry about 65 pullets. This system entails considerable investment in a permanent building that is in use only a short time each year. But where the colony house brooders are used, the same houses are often converted into colony houses by removing the coal stove and hover. After the brooding stage, the young pullets, which are then from 6 to 8 weeks of age, are placed on free range.

Colony Houses

The colony houses on the range ordinarily have a capacity of 50 to 100 pullets, the most common sizes being 6 by 8, 7 by 8, or 8 by 10 feet, usually of the shed roof type. Here in addition to the green forage growing on the range, such as rape, wheat, rye, clover or alfalfa, the pullets have mash and grain before them in the houses at all times, usually placed in separate boxes or hoppers sufficient to last about a week.

Pullets

The pullets are left on the ranges in the colony houses until ready to lay, which is not later than October first, with the exception of some of the May-hatched birds, which may be brought in before laying, to avoid being exposed to the cold fall rains.

When brought in from the ranges, the pullets are placed in separate pens in the laying houses, usually anywhere from 50 to 200 in a pen. At this time, there is another culling out and the cull pullets are sold off for meat. This habit of culling is being more and more rigidly practiced now that the price of all feeds is so high, as it is essential to keep only the best stock over winter. From now on the pullets are treated as the laying hens, or yearlings.

Yearlings

In the survey, all hens kept after the pullet year are classed as yearlings. The number of hens kept longer than the second laying year was very few, not exceeding 3 per cent of the total. Thus the yearlings consist practically of those pullets which have

shown the best records during their first laying year. That is, the pullets are carefully culled out before being carried over another winter as yearlings, and those selected are used largely as breeders for hatching eggs. This culling starts about the middle of June and continues to fall. The great bulk of cull birds are sold off during August and September, probably 75 per cent of the total.

These selected yearlings with the new pullets constitute the laying flock carried over winter.

Cockerels

The young cockerels are separated as soon as distinguishable. Those from the early February and March hatches are raised to broiler size and sold. The cockerels from later hatches of April and May are sold off at the age of four to five weeks, when they bring from 7 to 15 cents apiece. This of course, is a losing price, but it is done for two reasons: First, the intensive system of poultry keeping allows no room for the raising of many chicks to broiler size, and as the succeeding hatches come off, all the available room is used for raising young pullets, thus maintaining the largest laying flock possible. Second, the broiler prices become very low by the time of the last hatches and do not allow much of a margin for profit.

The young cockerels sold in this way are used chiefly for two purposes: first, they are purchased by suburbanites in small numbers, who are able to raise them to meat size on table scraps and waste food, thus producing a good wholesome cheap meat for themselves; and second, they are purchased in considerable quantities by large asparagus growers in South Jersey to use in the asparagus fields as insect destroyers.

A few cockerels have to be kept over for breeding purposes and the right selection of these is one of the most important points in a successful poultry business. Much of the laying power of a hen is transmitted through the male bird, therefore special care is being taken to secure these breeding cockerels by the successful poultryman. Special cockerel matings are made; that is, one or two extra good cockerels are mated with a few of the strongest laying hens, as indicated by trap-nesting records or

otherwise, and the best cockerels from the eggs thus secured are saved for the next matings. The practice has been to keep these breeding cockerels one year and then sell them off. With the increase of February hatching, the best cock birds are kept over a second year to be mated with February pullets. Except when producing hatching eggs, covering a period of approximately 5½ to 6 months, the cockerels are kept by themselves in a cockerel house. The proportion of cockerels to hens in the breeding pens varies from 1 cockerel to 15 hens up to as high as 25, with 18 or 20 commonly considered the best.

The Laying Flock

Size of Flock

The total number of pullets and old hens a poultryman has on November first is generally considered to be the size of the laying flock for the year, as the poultryman's business year is usually taken from November first to November first of the following year. By that time the young pullets are brought in off the range, and culled thoroughly, and all the old hens have been sold off except those saved as breeders.

Housing

The prevailing type of house in the Vineland area, as well as the other areas discussed in this bulletin, is the long shed-roof house. Next in popularity is the half monitor style, but most of the newer houses and those in course of construction are of the shed roof type, which is the more economical. These houses are usually 14 to 16 feet wide, and the length is governed by number of birds kept. The longer laying houses are divided into sections accommodating 50 to 200 birds in a pen. In some instances, instead of having a single laying house divided into pens, the flocks are kept in entirely separate houses. This means greater building cost per bird housed, and more labor in caring for them. The capacity of the laying houses is figured on the basis of three to four square feet per bird of the White Leghorn type, the average on the 150 farms being 3.9 square feet per mature bird.

The flooring in the laying houses consists of dirt, wood, or concrete. Litter is always kept on the floors, so that the hens have to scratch and exercise in getting their grain, and for this purpose wheat straw is preferred, but when not obtainable oat or rye straw is used.

Trap-nesting

Keeping actual records of egg production per individual hen by trap-nesting banded or numbered birds was not the common practice, but there were 9 of the 150 poultrymen on this survey, who were regularly trap-nesting.

Feeding

There are two general methods of feeding in practice. In one method, the mash is placed in large self-feeding hoppers holding five hundred to one thousand pounds of feed and these need to be refilled once a week or whenever empty. Then the grain ration is fed twice a day, morning and afternoon.

In the other method, fresh mash is put out every morning and grain is fed once a day in the afternoon. By feeding in this way the poultryman can keep track of the mash eaten each day and vary his feeding to meet the birds' requirements more closely than when large hoppers are used. However, the large hoppers are a labor-saving device and hence desirable from this standpoint.

The feeding of the birds requires the close attention of the poultryman, as it is varied considerably according to the egg production and weather conditions.

The majority of the poultrymen are buying their grains separately and mixing the feed themselves. While this method involves extra labor, the poultryman is more certain of having just the mixture desired.

Feed mixtures and rations were based almost entirely on the recommendations of the New Jersey Agricultural Experiment Station. There were a number of variations to meet individual preference or special conditions, but the New Jersey ration was the most common.

The New Jersey ration used in the Vineland Egg Laying Contest was made up as follows:

NEW JERSEY CONTEST MASH

Wheat bran, 100 lbs.
Wheat middlings, white or flour, 100 lbs.
Ground oats, standard or better, 100 lbs.
Corn meal, pure, 100 lbs.
Meat scrap, 50 per cent protein, 100 lbs.

While the ration varies with the weather, relative prices of grain, and the like influences, this probably represents closely what was ordinarily used by these poultrymen.

The above dry mash was generally supplemented by a scratch ration composed of cracked corn, wheat and oats. These grains were usually mixed in equal parts, except during the winter months, when it was a common practice to double the amount of cracked corn.

Successful feeding involved the maintaining of the proper relation between the amount of mash and grain consumed. It was the general practice to feed slightly greater amounts of grain than of mash, except during the spring or season of heavy production, when the mash consumed usually equaled or exceeded the amount of grain fed.

RANGES

Ranges occupy, on the average, 3.2 acres per farm, or over 27 per cent of the total farm area. The ranges are divided into almost equal separate parts for the laying flock and for the young or growing stock. Such crops as rye, wheat or clover, or occasionally alfalfa, are sown in late summer or early fall and produce a good growth ready for the use of the birds as early in the spring as the weather is fit for them to be outside. Rape is used very commonly and is sown in the spring, more especially on the young-stock ranges. When space permits, the poultrymen have alternate ranges, so that while the birds are using one section, the other section is plowed up and a new crop sown. Where this is practiced the ranges furnish all the green material required for a period of approximately seven months—April to October. In a few instances, corn was planted on the ranges and allowed to become a foot high before turning chickens into it.

This furnished shade as well as some green material. As a rule, the poultrymen had fruit trees to furnish shade in the poultry yard, the peach being most frequently used.

SUCCULENT CROPS

Green material or succulent feed of some sort is essential in the poultry business. The poultrymen are making it a practice to grow enough for their own needs; there were but two poultrymen in this survey who were buying green feed, such as mangel wurzels.

For winter green or succulent food the poultrymen aim to raise such crops as mangel beets or cabbage, which can be stored for the winter. Mangel beets occupied a total of 25 acres, cabbage 11.4 acres and kale 1.5 acres on these 150 farms. In addition to these main crops, occasionally lettuce is used. In one case, sprouted oats were used; but they are an expensive source of green material, and involve considerable labor.

In feeding the beets, they are either cut up fine, or merely suspended on a string from the house roof for the chickens to peck at.

METHODS OF STUDY

Information was gathered for this study by visiting each farm in person and getting the poultryman's farm organization receipts, expenses and inventory of the entire business. The egg and chicken receipts, and expenses for feed were on 98 farms obtained direct from the poultryman's chicken account. Where no accounts were kept the amounts were carefully given from the farmer's memory, assisted by partial records and checked by Mr. Waller. Such a study has vast possibilities for obtaining information about a subject. This is primarily a study of the business of poultry farming. So far as the authors are aware no like publication has been presented upon poultry farming as a business.

The probable reason for this is that so few states have a poultry industry that affords such excellent opportunities for study. Most poultry is a side issue on the farm, and of comparatively small importance. These farms studied in this survey derive

98 per cent of their entire receipts from poultry. Such a condition simplifies the study of the industry. Besides, these poultrymen buy practically all their feed except greens, such as cabbage, pasture and roots. Their energies are given almost exclusively to care of poultry.

Breeds of Poultry

The average farm flock is composed of mongrels or mixed breeds. They are bred with little or no attention to breeding high-class birds. On these farms we find an entirely different status. Most of the birds are from one breed and practically all are pure-bred.

Table 2

Breeds of Chickens Found on 150 Poultry Farms in New Jersey

Breed	Number of Laying Birds		Number of Farms	
	Nov. 1, 1915	Nov. 1, 1916	Nov. 1, 1915	Nov. 1, 1916
White Leghorns,	105,568	118,364	149	149
Rhode Island Reds,	716	1,520	9	15
Anconas,	700	700	2	2
White Wyandottes,	356	679	5	8
Barred Rocks,	111	328	3	4
Columbian Wyandottes,	250	238	1	2
Buff Rocks,	92	137	2	2
Black Minorcas,	15	80	1	1
Mongrels,	38	38	1	1
White Plymouth Rocks,	22	25	1	1
Black Sumatras,	20	20	1	1
Black Leghorns,	20	20	1	1
Campines,	20	20	1	1
Buff Leghorns,	15	18	1	1
Brahmas,	20	12	1	1
Other Breeds,	8	8	1	1
Total Laying Birds,	107,971	122,207	150	150
Cockerels,	2,546	3,252	...	...
Grand Total,	110,517	125,459	150	150

The number of farms having breeds other than White Leghorns was 31 on November 1, 1915, and 42 on November 1, 1916. White Leghorns constituted 97.8 per cent on November 1, 1915, and 94.3 per cent of the total on November 1, 1916. The meat breeds are kept for the poultryman's own table use as a source of meat supply. The White Leghorn is not a good meat fowl, but is primarily an egg producer. This breed is to the egg industry what the Holstein cow is to the market milk industry,

and these poultry farms are run primarily for egg production. The fact that the White Leghorns predominate almost exclusively, would indicate that these poultrymen fully recognize the superiority of this breed. The breed is hardy, full of vitality and comparatively easy to raise. The pullets mature early. White Leghorns are economical egg producers, and are a desirable breed for egg production.

Poultry Farms Included in the Survey

On 100 of these 150 poultry farms, the operators sold nothing but poultry products, while on the other 50 some truck and fruit were sold, but in no case over 40 per cent. The average amount of the sales for products other than poultry products on these 50 farms was $188 per farm. This is not a large amount and would not influence the results materially.

Thus these farms are run primarily or exclusively for poultry products, of which eggs are the most important. A study of such farms provides definite information on the profits to be expected from poultry when they are not produced on cheap feed and labor. It shows conclusively whether poultry can successfully compete with other types of farming. It is seldom that we find such a highly specialized type of farming so well defined. Specialization is frequently decried as unprofitable. But the proper kind of specialization can be made profitable. This does not apply to the exceptional man only, but in this case includes an entire class.

Farm Tenure

These 150 farms were occupied entirely by owners. In this respect they differ radically from most other types of farming. The chief reason for this is the comparatively small amount of capital necessary for poultry farming. In addition to this, the business on these farms is usually but a one-man business. A one-man business usually will not produce sufficient profits for a landlord and tenant to share. Sometimes a large proportion of owners indicates small profits. However, in this case it simply indicates a small business. Thus the form of tenure is not a true criterion of the profits derived from farming in all cases. For

potato, general, and dairy farming in New Jersey, it did serve as a guide. However, poultry farms can be established on a small amount of capital, and therefore land tenure is not a criterion of prosperity on these poultry farms.

While poultry is the second most profitable type of farming here presented, there were no tenant farms. Thus the prosperity as measured by labor income is not an absolute guide for the condition of tenantry. For the amount of capital invested, poultry farming is the most profitable type. Here is a type of farming which will allow the man with limited capital to make a comfortable living. For the city-bred man, it probably is the type in which he can best succeed. It is highly specialized and does not require so much knowledge of soils, fertilizers, crops, and farm practice as most other types of farming. While successful poul-

TABLE 3

Profits Derived from Different Farm Types in New Jersey and Its Relation to Farm Tenure

FARM TYPES	Owner Farms				Tenant Farms	
	Number	Labor Income	Capital Invested Per Farm	Farm Income	Number	Labor Income
Potato,	194	$917	$17,673	$1,801	149	$753
General,	192	491	13,602	1,071	68	653
Truck,*	300	412	11,494	987	....	...
Dairy,	300	457	11,259	1,020	160	557
Poultry,	150	730	7,243	1,092	....	...

* Owner and Tenant Farms.

try farming requires skill on the part of the operator, the requirements are not so broad as for many other types of farming, making the business more easy to acquire.

CAPITAL

It is sometimes stated that the same amount of capital is required for success in any type of farming. However, for poultry farming, the amount necessary for success is less than for the other types found in this state. This is a decided advantage. For a young man to start out and earn sufficient capital to buy and equip the average farm to-day, is a difficult task. For the

man from the city, who has but \$5,000 to \$10,000 saved from his earnings, capital is usually his limiting factor for success. So far as the results of the survey of all the farm types that have been studied in this department show, poultry raising is the most successful operation for farmers having small capital.

Amount of Capital and Distribution

The average capital per farm was \$7,243, a very moderate sum when compared with that of other farm types in New Jersey.[2] Of this amount, 76.9 per cent is in real estate and 15.8 per cent in stock, 4.3 per cent in machinery, 1.5 per cent in supplies and 1.5 per cent in cash. The proportion in real estate is small when compared with that of other types of farming, but the buildings are worth an average of \$2,925, or 52 per cent of the real estate value. The poultryman's dwelling is worth \$1,662, or about 30 per cent of the total real estate value. Much of this investment is necessary for the operator's house. The necessary investment in land is comparatively small, yet the value per acre is \$480, a comparatively large amount. The buildings and fences added to the land have materially raised the acre value, the buildings alone having an acre value of \$250, leaving an acre value for land and fences of \$230. The average value of land itself was about \$200 per acre. This value is largely on account of

TABLE 4

Amount and Distribution of Capital on 150 Poultry Farms in New Jersey

CAPITAL PER FARM	Number of Farms	Real Estate		Stock		Machinery		Feed and Supplies		Cash		Total Capital
		Value	Per Cent of Total	Value	Per Cent of Total	Value	Per Cent of Total	Value	Per Cent of Total	Value	Per Cent of Total	
\$3,000 or less, ...	3	\$1,900	76.9	\$431	17.4	\$66.70	2.7	\$33.30	1.5	\$33.30	1.5	\$2,470
\$3,001 to \$5,000, ..	29	3,217	74.7	802	18.6	179.20	4.2	54.10	1.4	49.10	1.1	4,298
\$5,001 to \$7,000, ..	45	4,638	78.4	905	15.6	229.90	3.9	61.60	1.0	64.80	1.1	5,924
\$7,001 to \$9,000, ..	38	6,125	76.6	1,307	16.3	329.50	4.1	117.60	1.5	116.20	1.5	7,995
\$9,001 to \$11,000, .	22	7,673	77.9	1,456	14.8	411.80	4.2	163.50	1.7	138.40	1.4	9,841
\$11,001 and over,	13	9,731	75.1	1,837	14.8	709.30	5.5	302.40	2.3	296.90	2.3	12,876
	150	\$5,572	76.9	\$1,146	15.8	\$310.30	4.3	\$109.60	1.5	\$105.10	1.5	\$7,243

[2] See N. J. Agr. Exp. Sta. Bulletins 294, 312 and 320.

location and not because of high fertility. Prices have increased much during the last few years.

Amount of Capital and Labor Income

Like other types of farming, greater profits are derived when sufficient capital is available for conducting an economic business of large volume. On these 150 poultry farms, profits increased with each increased investment until the class of farms having over $11,000 was reached (table 5). This class had slightly decreased profits.

TABLE 5

Relation of Capital to Profits on 150 Poultry Farms in New Jersey

CAPITAL	No. of Farms	Average Capital	Birds Per Farm	Labor Income	Investment Per Bird
$3,000 or less, ...	3	$2,470	332	$196	$7.44
$3,001 to $5,000, ...	29	4,298	513	351	8.38
$5,001 to $7,000, ...	45	5,924	616	580	9.63
$7,001 to $9,000, ...	38	7,995	852	743	9.38
$9,001 to $11,000, ...	22	9,841	923	1,270	10.66
$11,001 and over, ...	13	12,876	1,095	1,259	11.76
	150	$7,243	737	$730	$9.83

Though the number of farms is too small to permit the drawing of absolute conclusions, these data would tend to show that an investment of $15,000 or more, in the hands of the average poultryman, would not return so great a profit as $10,000 to $12,000. The highest labor income ($3,867) was obtained from an investment of $10,910. The highest amount of capital per farm was $15,455, and the labor income from this farm was $1,216. The investment per bird increases with increased capital. Apparently, this increased capital is for a larger business as well as a more pretentious outlay. This large investment has been made from the standpoint of pleasure as well as of business.

The lowest investment per farm was $2,131, and this farm gave a minus labor income of $208. The greatest loss was a minus labor income of $1,013, on a farm where the capital amounted to $6,092. Much of this loss was due to sickness and dying of the chickens.

Return on Capital Invested

The capitalist is usually most interested in the rate of interest he will receive on the money he invests. The farmer is more interested in the total return above his 5 per cent interest charge.

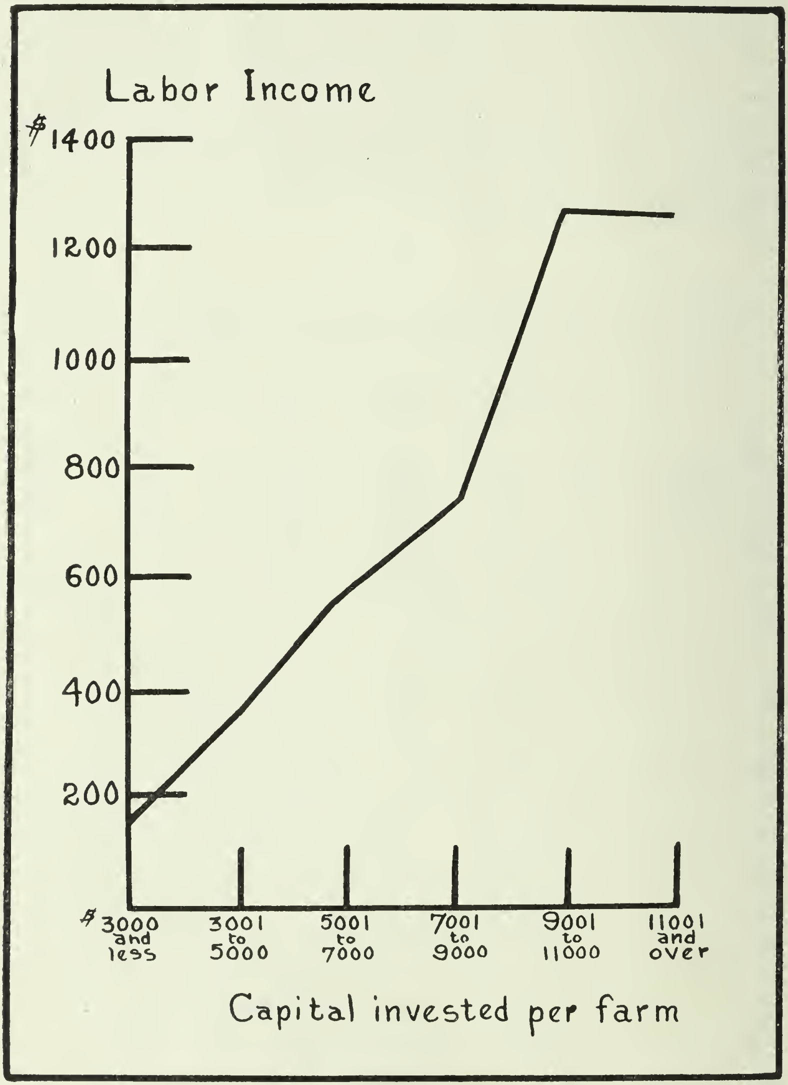

Fig. 2. Relation of Capital to Labor Income on 150 Poultry Farms in New Jersey.

If $15,000 will return $2,550 above expenses, the return would be at the rate of 17 per cent on the investment. Should the

farmer invest $10,000 and receive $1,800 above expenses, the return on the money invested would be 18 per cent, or a higher rate of interest, but less money is left for the farmer to live upon after deducting the 5 per cent interest. In such a case the operator could afford to increase his business with a $5,000 added investment and be more prosperous. The farmer views the business as a unit from which to obtain a living, and not as a mere investment.

TABLE 6

Relation of Capital to Return on Investment on 150 Poultry Farms in New Jersey

CAPITAL	No. of Farms	Return Per $1,000 Invested	Per Cent Return
$3,000 or less,	3	$129	12.9
$3,001 to $5,000,	29	132	13.2
$5,001 to $7,000,	45	138	13.8
$7,001 to $9,000,	38	143	14.3
$9,001 to $11,000,	22	179	17.9
$11,001 and over,	13	148	14.8
	150	$151	15.1

The average return on the investment was 15.1 per cent (table 6). To obtain this the operator gave all his time and supervision. The highest return was obtained for an investment of $9,000 to $11,000. This appears to be the most efficiently capitalized unit for these poultry farms. A man should have at least $5,000 to $7,000 before he can hope to be moderately successful with poultry.

SIZE

The size of these poultry farms is best measured by the number of fowls per farm or per flock. In most types of farming we usually find that the size of farm, number of crop acres, or the amount of livestock should be above the average in size to be most profitable.

Relation of Size of Flock to Labor Income

The average number of chickens per flock on these farms was 736, of which 17 were cockerels. There was an average of 43

hens per cockerel. The labor income for these flocks increased with each increase in size of flock. The lowest labor income per flock was received on farms having less than 300 birds, while the highest was from the farms having over 1500 birds per flock (table 7).

TABLE 7

Relation of Number of Fowls per Flock to Profits on 150 Poultry Farms in New Jersey

Number of Fowls per Flock	Number of Farms	Average Number of Fowls Per Flock, Nov. 1, 1915	Average Number of Hens per Flock, Nov. 1, 1915	Cockerels Per Flock	Number of Hens Per Cockerel	Labor Income	Labor Income Per Hen	Number With Minus Labor Income
300 or less, ..	19	255.7	249.1	6.6	37.8	$178	$0.71	7
301 to 500,..	42	446.2	437.5	8.7	50.0	313	0.71	8
501 to 700,..	29	621.2	607.8	13.4	45.6	423	0.69	8
701 to 900,..	23	842.5	823.7	18.8	43.7	779	0.94	1
901 to 1100,..	12	1025.5	998.0	27.5	36.2	1,387	1.39	1
1101 to 1500,..	17	1338.8	1308.8	30.0	43.6	1,668	1.27	2
1501 and over,	8	1806.8	1757.5	49.3	35.5	2,217	1.26	0
Average, ...	150	736.8	719.8	16.9	42.4	$730	$1.01	27

These flocks have not, as a class, become too large for the greatest profit. The greatest profit per hen was obtained from flocks of from 900 to 1100 birds. Larger than this, the profits per bird began to decrease. When smaller than this, the profits likewise decreased. From the standpoint of the individual hen, this was the most efficient unit, or size of flock. But for larger total profits per flock, a larger number of birds is necessary. The 8 farms having an average of 1807 fowls per farm gave the largest labor income. How much more these flocks could be increased and bring a larger profit is not shown on these farms. It appears, however, that the profits per bird begin to decrease, since the labor income per hen is only $1.26 in the largest class, apparently as the result of the greater size of flock. Should a man wish to keep or develop a poultry industry of great size, it probably would be advisable to maintain units of a certain size, that is, about 2000 fowls per unit or a flock each large enough to keep two men busy throughout the year.

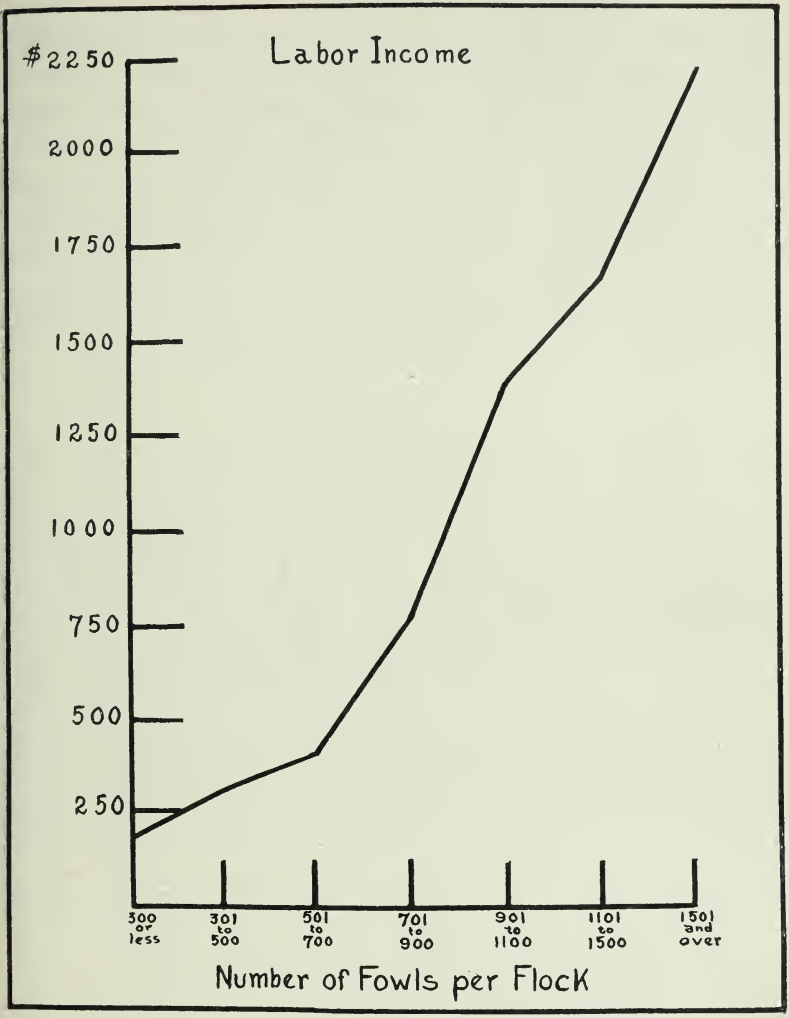

Fig. 3. Relation of Number of Fowls per Flock to Labor Income on 150 Poultry Farms in New Jersey.

Relation of Size of Flock to Farm Organization

In all business there is a certain size which is most desirable and most profitable, because this size allows the most efficient operation, of man labor, horse labor, machinery and buildings all costing less in proportion to the service they render in producing crops and stock products.

In the average flock it required one man's time for almost two months to care for 100 fowls, and in the small flocks 4.3 months, while in the 8 largest flocks one man cared for 100 birds in 1.6 months (table 8). When the man's time is reduced to money value, we find it cost $182 to care for 100 birds per year in the small flocks, while in the large flocks it cost but $65, or a trifle above one-third as much. The average cost per 100 birds was $81 per year for man labor. With such a great difference in labor cost per 100 birds for the large flocks, it should be much easier to make more money per hen. The larger flocks are far more efficient units for operation than the smaller ones.

TABLE 8

Relation of Size of Flock to Labor Expense on 150 Poultry Farms in New Jersey

NUMBER OF FOWLS PER FLOCK	Number of Farms	Labor Cost Per Farm Besides Operator's	Months Worked by Operator	Total Man Labor; Months	Months of Man Labor Per 100 Birds	Total Value of Man Labor	Cost Per 100 Birds	Number of Horses Per Farm
300 or less,	19	$18,10	10.5	10.9	4.3	$465	182	0.6
301 to 500,	42	69.00	10.4	12.1	2.7	517	115	0.5
501 to 700,	29	33.50	11.6	12.4	2.0	530	85	0.2
701 to 900,	23	104.10	11.7	14.2	1.7	606	72	0.5
901 to 1100,	12	185.10	12.0	16.4	1.6	700	68	0.5
1101 to 1500,	17	256.80	11.9	18.0	1.3	770	57	0.6
1501 and over,	8	668.60	11.2	27.2	1.6	1161	64	1.1
Average,	150	$123.90	11.2	14.1	1.92	$597	81	0.5

Horse labor on these farms was relatively unimportant. Less than half of the farms had horses. There were 75 horses on 150 farms. Many farms had no need for horse labor except a small garden and patch for roots and green feed, such as cabbage. For this they could hire horse labor far cheaper than they could keep a horse and do it themselves. Around the Vineland area many poultrymen took their eggs to the trolley car in wheelbarrows. This was the cheapest form of transportation found in the area.

The total value of equipment per farm increases but not in proportion to the number of crop acres (table 9). The value of the equipment used for poultry alone decreased approximately 50 per cent on the larger farms. After a size of 700 to 900 fowls per flock was reached, the efficiency in the use of poultry equipment no longer increased to any apparent extent. As far as the use of poultry equipment was concerned, a flock of 701 to 1100 was as efficient as or more efficient than any other size.

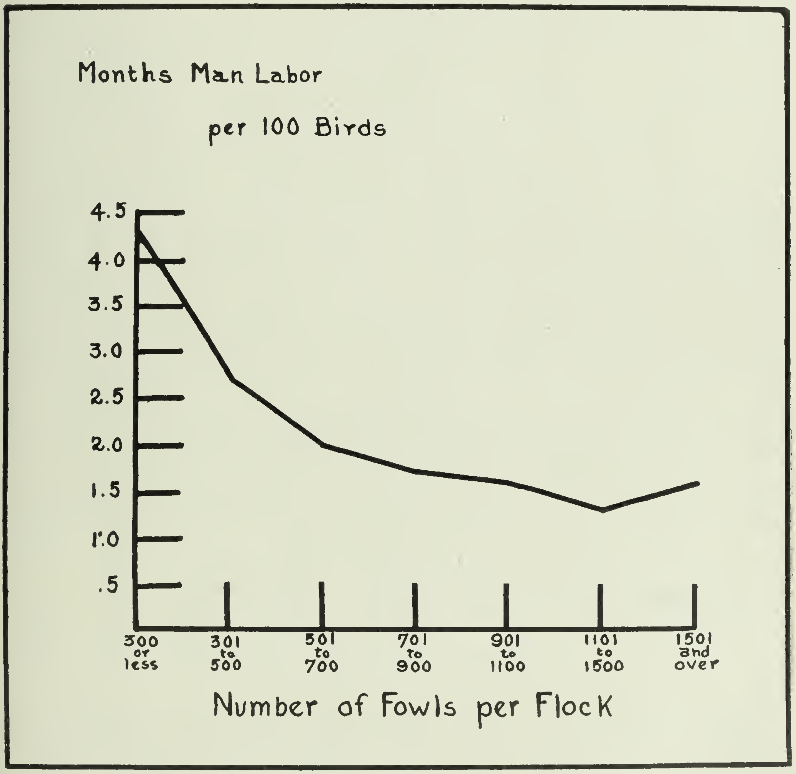

Fig. 4. Relation of Size of Flock to Labor Expense on 150 Poultry Farms in New Jersey.

The building investment (table 10) shows very much the same relation to size of flock as equipment and labor. The average value of poultry buildings per bird was $1.54. On the smallest class of farms this was $2.79, while on the largest it was $1.09 per bird, or less than half as great. When we usually find that

the rate of depreciation on buildings is 3 per cent, the interest 5 or 6 per cent and insurance 1 per cent, or a total of about 10 per cent, we can appreciate the difference in the charge for building cost per hen. This would amount to about 27 cents per hen for the small flocks and 11 cents per hen for the large ones. This is a large item for overhead expense.

TABLE 9

Relation of Size of Flock to Equipment Investment on 150 Poultry Farms in New Jersey

FOWLS PER FLOCK	No. of Farms	Total Equipment			Poultry Equipment	
		Per Farm	Per Crop Acre	Per 100 Birds	Per Farm	Per 100 Birds
300 or less, ...	19	$183	$46	$72	$152	$59
301 to 500, ...	42	232	52	53	157	35
501 to 700, ...	29	280	95	45	234	38
701 to 900, ...	23	291	95	35	231	28
901 to 1100, ...	12	282	58	28	210	21
1101 to 1500, ...	17	545	69	41	452	34
1501 and over, ...	8	720	74	39	346	19
	150	$310	$67	$42	$230	$31

TABLE 10

Relation of Size of Flock to Building Investment on 150 Poultry Farms in New Jersey

FOWLS PER FLOCK	Farm Value					Value of Poultry Buildings Per Bird	Proportion of Total Real Estate Value
	Dwelling	Colony House	Brooder House	Feed House	All Poultry Buildings		Per Cent
300 or less, ...	$1357	$67	$117	$107	$714	$2.79	16
301 to 500, ...	1731	51	205	105	955	2.14	17
501 to 700, ...	1741	54	203	110	996	1.60	18
701 to 900, ...	1598	92	263	157	1125	1.33	21
901 to 1100, ...	1658	206	384	160	1206	1.17	19
1101 to 1500, ...	1712	179	334	206	1781	1.33	29
1501 and over, ...	1813	150	350	375	2138	1.09	30
Average, ...	$1662	$89	$233	$137	$1135	$1.54	20

The poultryman's dwelling on most of these farms was modest and not so pretentious as the dwellings on some other types, such as potato, dairy, truck or general farms. However, most of them were comfortable and adequate.

Relation of Size of Flocks to Receipts and Expenses

All business will reach a point of diminishing returns, if increased indefinitely. Whether these poultry farms in the largest class are returning the largest receipts per hen might be questioned by the small-flock enthusiast.

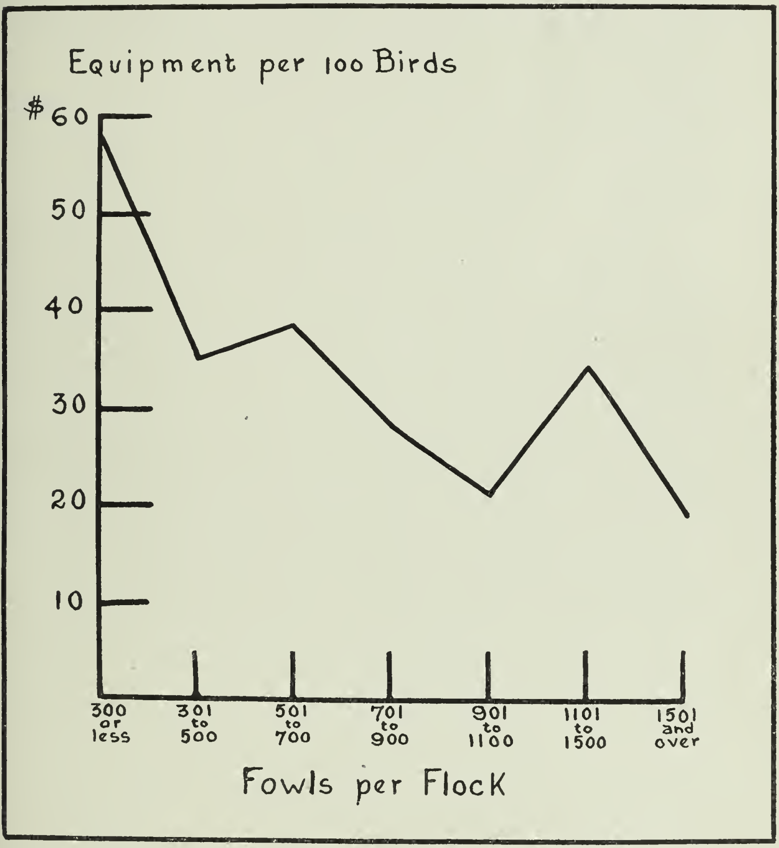

Fig. 5. Relation of Size of Flock to Equipment Investment on 150 Poultry Farms in New Jersey.

The egg production per hen as well as the egg receipts per hen are about the same regardless of the size of flock. Consequently, the large flocks are not too large for normal production. The total receipts per bird are greater on the farms having a small number of birds per flock because proportionally more chickens are raised. These chickens were included in the inven-

tory at the end of the year, and considered in the calculations the same as a receipt. The crop receipts are likewise somewhat greater. Another significant fact about these small flocks is that

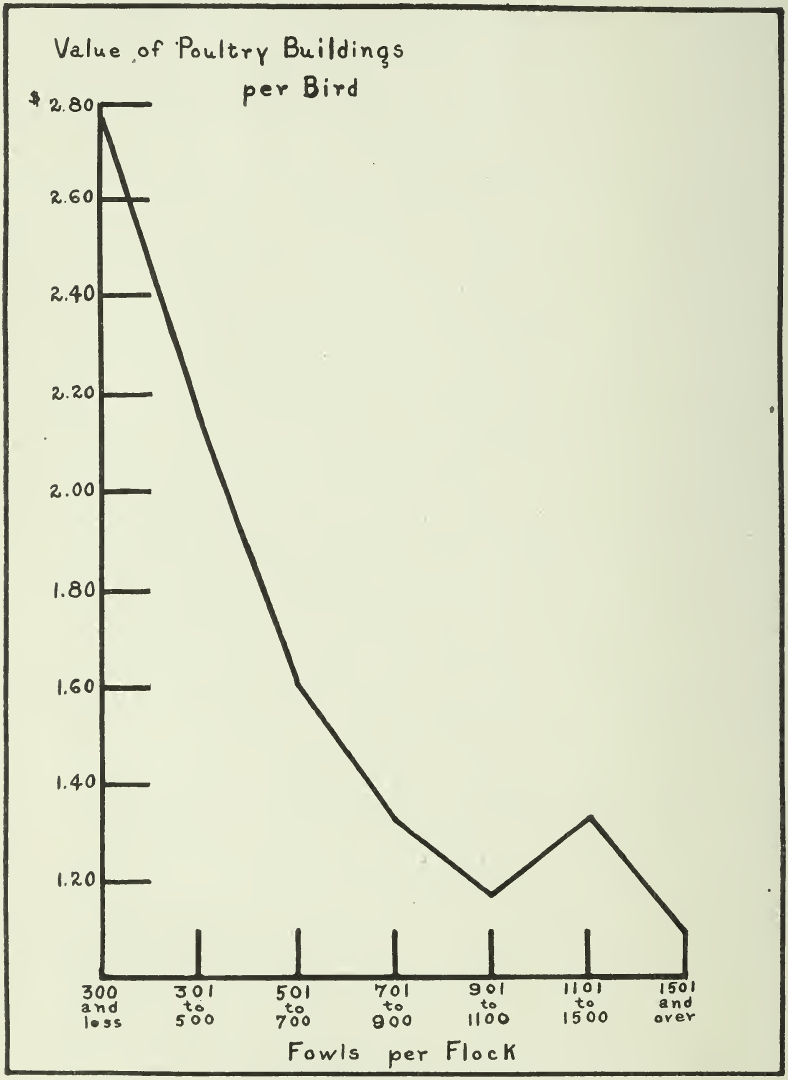

Fig. 6. Relation of Size of Flock to Building Investment on 150 Poultry Farms in New Jersey.

more old hens are kept over for the following year. Only one-third of the flock is sold as culls during the year, while for the larger flocks about half are sold as culls. The poultrymen who

TABLE II

Relation of Size of Flock to Receipts on 150 Poultry Farms in New Jersey

FOWLS PER FLOCK	Eggs		Egg Receipts		Cockerels and Broilers		Old Fowls Sold			Pullets Sold		Crop Sales Per Farm	Total Receipts		Per Cent of Fowls Sold as Old Fowls
	Total Per Hen	Used for Hatching and Table Per Hen	Per Farm	Per Hen	Number	Value	Number	Per Cent of Entire Flock	Value	Number	Value		Per Farm	Per Bird	
300 or less, ...	115.2	7.2	$748	$3.00	382	$88	81	32	$49	46	$26	$92	$1304	$5.10	33
301 to 500, ...	109.2	4.8	1293	2.90	478	110	192	40	122	51	26	93	1883	4.20	44
501 to 700, ...	98.4	5.8	1607	2.60	567	145	247	43	152	88	73	49	2153	3.50	41
701 to 900, ...	101.9	4.7	2185	2.60	613	147	357	49	259	60	38	56	2855	3.40	43
901 to 1100, ...	117.5	3.5	3211	3.20	929	284	499	49	407	101	95	25	4059	4.60	50
1101 to 1500, ...	108.6	6.6	3842	2.80	1032	234	576	42	371	98	125	26	5032	3.80	44
1501 and over, ...	121.2	2.4	5726	3.20	1102	445	788	42	476	85	76	37	6854	3.80	45
Average, ...	108.8	5.6	$2100	$2.90	636	$166	314	43	$209	70	$56	$62	$2818	$3.820	44

have small flocks are endeavoring to increase their size and consequently sell fewer old fowls, as well as raise a larger proportion of chickens. Since more old fowls are kept over, it might be expected that the egg production per hen would be less, but this does not prove to be the case, as it is somewhat above the average.

TABLE 12

Relation of Size of Flock to Expenses on 150 Poultry Farms in New Jersey

FOWLS PER FLOCK	Total Expense		Depreciation		Per Cent of Deaths	Feed Cost			Amount of Receipts Above Expense Per Bird
	Per Flock	Per Bird	Per Flock	Per Bird		Per Flock	Per Bird	Per Dozen Eggs Sold	
300 or less,	$845	$3.30	$109	$0.04	4.5	$632	$2.47	$0.28	$1.80
301 to 500,	1236	2.77	140	.03	4.3	896	2.01	.23	1.43
501 to 700,	1383	2.22	144	.02	8.0	1057	1.70	.28	1.28
701 to 900,	1724	2.04	143	.02	5.5	1329	1.58	.20	1.36
901 to 1100,	2251	2.20	165	.02	5.4	1712	1.67	.18	2.40
1101 to 1500,	3001	2.24	198	.01	11.0	2321	1.73	.21	1.76
1501 and over,	4097	2.26	215	.01	7.6	3038	1.68	.18	1.74
Average,	$1726	$2.34	$150	$0.02	7.1	$1301	$1.76	$0.21	$1.48

The average expense per flock on these farms was $1726, while the average receipts were $2818, leaving a farm income of $1092 (table 12). In addition to this, the operator had his house in which to live, and produce for his own use from his farm.

The expense per bird was about the same after flocks of over 500 were reached. The expense per dozen eggs produced was about the same in flocks of 700 birds and above. The depreciation of equipment decreased up until 900-bird flocks were reached. In a flock of 1000 or more hens, the profits were greater than in smaller flocks, because the business was of greater size and not because it was more economical. The maximum efficiency of operation per bird or dozen of eggs produced was reached on the plant of about 1000 birds. These plants could be increased to advantage until the receipts per bird decreased or the expenses per bird increased to the point where there is no longer any profit. The size of the flock where this would occur is not shown on these farms. Apparently no class had reached the size for maximum profits. Probably a unit of 2000 to 3000 birds would be about the most profitable.

Relation of Size of Flock to Investment

When investing money in a business it is essential that the investment be made in such a way that it will provide for a large production at a relative low overhead cost for buildings, equip-

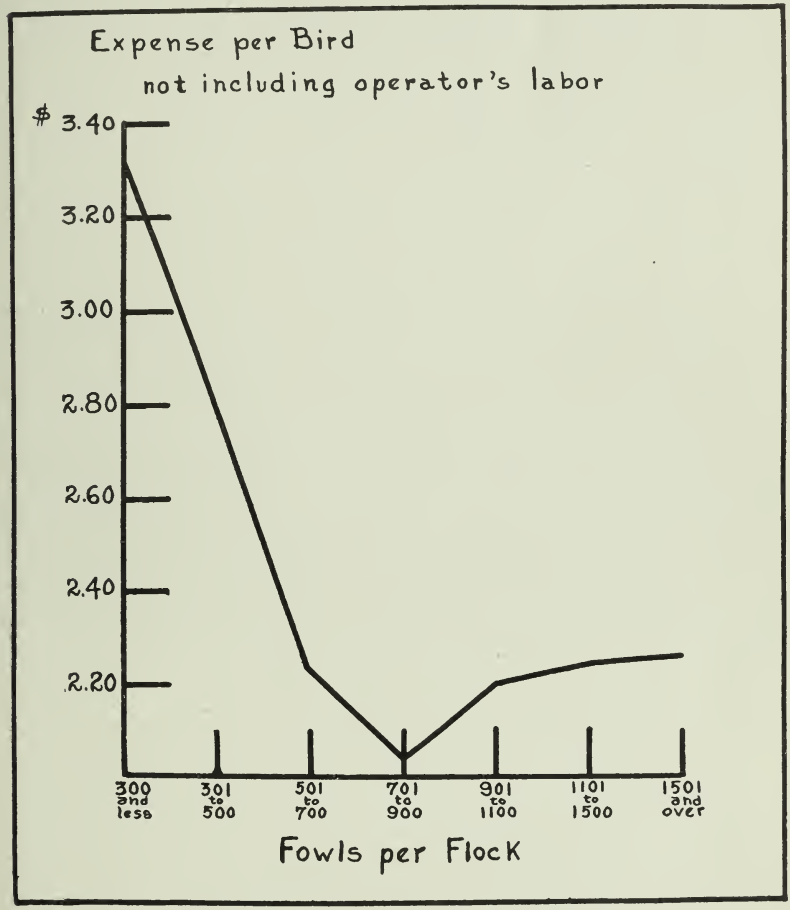

Fig. 7. Relation of Size of Flock to Expenses on 150 Poultry Farms in New Jersey.

ment, land, etc. On poultry farms, the operator should have as large a proportion of his capital as feasible in poultry, and only sufficient in overhead investment as to provide for the proper care of the birds.

TABLE 13

Relation of Size of Flock to Proportion of Investment in Poultry on 150 Poultry Farms in New Jersey

FOWLS PER FLOCK	Capital				Per Cent of Capital in Livestock
	Total Per Farm	Real Estate Per Farm	Livestock Per Farm	Cash Per Farm	
300 or less,..	$5221	$4368	$594	$36	11
301 to 500,...	6687	5532	818	55	12
501 to 700,...	6922	5526	955	82	14
701 to 900,...	7035	5322	1211	102	16
901 to 1100,..	8410	6375	1492	137	18
1101 to 1500,..	9212	6179	1896	263	21
1501 and over,	10779	7025	2571	244	24
	$7243	$5572	$1146	$105	16

On the farms having the largest flocks 24 per cent of all the capital was in stock, while on the farms with small flocks only 11 per cent was in poultry (table 13). The average stock investment was 16 per cent. Since the poultry on these farms is almost the only source of income, it is important to have as large a proportion of the capital in it as possible. Capital invested in buildings and equipment brings no returns; it simply provides the facilities for caring for the birds so that they will afford an income. Consequently, the poultryman's problem is to invest money so as to have adequate facilities for the poultry, without incurring an undue overhead expense.

Relation of Size of Flock to the Number of Years the Operator has been in the Poultry Business

All the foregoing data have shown that the larger flocks on these areas were the more profitable. If this is true we might conclude that after a man had gained experience, skill and capital, he would increase the number of birds per flock.

As the poultrymen gain in experience and capital they increase the size of their flock (table 14). Starting with a small flock, they gradually add to it until they have over 1500 hens. This too is a good indication that a flock of 1500 to 2500 is about the most profitable for the farms found in the state.

TABLE 14

Relation of Size of Flock to Number of Years the Operator has been in the Poultry Business on 150 Poultry Farms in New Jersey

FOWLS PER FLOCK	Years Operator Has Raised Poultry
300 or less,	3.8 years
301 to 500,	4.6 years
501 to 700,	6.4 years
701 to 900,	7.1 years
901 to 1100,	7.5 years
1101 to 1500,	9.2 years
1501 and over,	18.7 years
Average,	6.7 years

PRODUCTION

The number of eggs produced per hen is important in just the same way as the amount of milk per cow or the yield per acre is important in making a profit on the farm. This phase of the poultry industry has received more attention from poultrymen than any other. To accentuate its importance, egg-laying contests have been conducted in the various states, poultrymen have trap-nested their hens to find the individuals that laid the largest number of eggs, while different methods of feeding and housing have been studied to find the factors best suited to egg production.

Relation of Production to Profits

Since the public has been giving so much attention to production we would expect it to be one of the big factors which influence profits in the poultry flock. At the same time, the poultryman does not always appreciate the full relation between the number of eggs produced per hen and profits.

These poultrymen did not begin to make money until their hens produced 90 or more eggs per year (table 15). They then made about as much as a hired man could make. But above this point they began to make good profits. The men who sold 148 eggs per hen received a labor income of $1823. None of these lost money. There were only 16 poultrymen, or 10 per cent of the

total, who obtained a production of 40 eggs (37 per cent) above the average production per hen for all the 150 farms. This average was 109 eggs, of which 103 were sold. The average production in the state in 1909 was 67 eggs, according to the 1910 census. A large proportion of the eggs are produced by the farm flock, which is a minor enterprise or side-issue on most farms. In such cases the eggs are usually produced at a smaller feed and labor cost per hen, as many farm flocks are allowed to hunt the major portion of their living throughout the summer. Consequently, for a profit they need not produce so many eggs as a purely commercial flock. The production in a commercial flock should be not much less than 30 per cent, or 110 eggs per hen, in order to pay profits under normal conditions. This requires a well-bred hen that will respond to care and feed. At present, with the high price of grain, this should be about 120 or more eggs per hen.

TABLE 15

Relation of Egg Production per Hen to Labor Income on 150 Poultry Farms in New Jersey

EGGS PER HEN	Number of Farms	Eggs Per Hen	Eggs Sold Per Hen	Egg Receipts Per Hen	Hens Per Farm	Average Labor Income	Number with Minus Labor Income
60 or less,	9	46	46	$1.30	505	—$176	6
61 to 80,	13	68	66	1.90	673	— 67	10
81 to 100,	32	91	88	2.30	650	312	5
101 to 120,	53	108	104	2.90	785	775	4
121 to 140,	27	126	120	3.40	717	1173	2
141 and over,	16	155	148	4.20	808	1823	0
	150	109	103	$2.90	720	$730	27

The highest-producing flock found in the survey produced an average of 186½ eggs per hen. There were only 350 hens in the flock, of which 300 were pullets. The receipts for eggs sold were $1935, or $5.83 per hen. This owner of this flock also sold 1400 baby chicks at 12 cents per chick, amounting to $168, 150 yearling hens for $90, and 600 cockerels at 33 cents, amounting to $200, making a total of receipts from these sources of $458. Besides this he raised 550 pullets. The total sales from poultry with the increased value of his flock at the end of the year

amounted to $3121, or $8.92 per hen, of which $5.53 was for eggs and $3.39 was for chickens raised and sold. This man

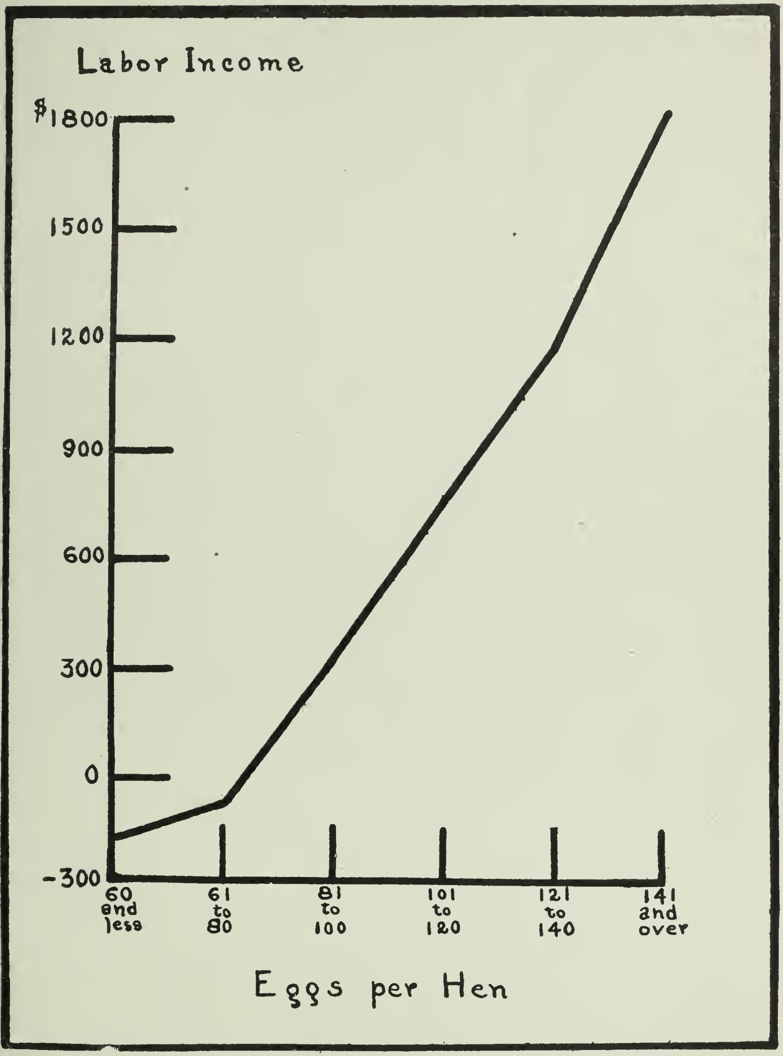

Fig. 8. Relation of Egg Production per Hen to Labor Income on 150 Poultry Farms in New Jersey.

bought $1106 worth of feed at a cost of $3.16 per bird.

The capital of this farm was invested as follows:

Real Estate,	$6,000
Dwelling,	1500
Poultry Building,	1050
Land (10 acres),	3450
Livestock,	1197
Machinery,	427
Feed,	125
Cash,	125
Total,	$7874

The livestock consisted entirely of poultry, except for one horse valued at $75 and one cow valued at $60. Of the machinery, about $250 was for the poultry. This consisted of 3 incubators, a gasoline engine, brooders and minor equipment.

The total expenses were $1465, of which $200 was for labor on fruit. The receipts from this fruit were $125; consequently, it was a loss for the farm. This man had been farming for 3 years, and was attempting to raise fruit and some truck with his poultry. The poultry was paying, but the truck and fruit were not. The farm income was $1603 and the labor income was $1249, a large labor income for 350 hens and 10 cockerels.

Thus, so far as production has increased, profits have increased. On none of these farms has the average production of the flocks been doubled. When a class of farms such as these is found, where the industry is highly developed, it is not easy to increase production to a great extent above the average. Only ten per cent reached a production over 37 per cent above the average, while the highest-producing flock was only 72 per cent above the average. There is a limit to the extent to which production can be increased. It is but one of the factors necessary for success in the poultry industry though one of the most important.

Relation of Production to Expenses and Receipts

It is not proper to consider the difference between feed cost of the hen and egg receipts as profit. Besides this item we have increased labor, increased investment, depreciation of birds, and other minor items which enter into the expenses of production and usually are increased when production is increased. Consequently, the profits of increased production are not always so large as they may appear.

The expenses per bird increase as production increases, but not so rapidly (table 16). But with the higher-producing classes the current expenses have increased more rapidly, showing that

TABLE 16

Relation of Production per Hen to Expenses on 150 Poultry Farms in New Jersey

EGGS PER HEN	*Current Expense		Feed Cost			Birds Per Farm	Total Labor		
	Per Flock	Per Bird	Per Farm	Per Bird	Per Dozen Eggs		Months Per Flock	Months Per 100 Birds	Cost Per 100 Birds
60 or less, ...	$1049	$2.00	$774	$1.48	$0.40	524	11.5	2.2	$93
61 to 80, ...	1467	2.09	1126	1.65	0.30	689	11.9	1.7	72
81 to 100, ...	1421	2.12	1107	1.66	0.23	666	12.3	1.8	76
101 to 120, ...	1862	2.32	1397	1.75	0.24	802	15.2	1.9	81
121 to 140, ...	1837	2.50	1376	1.88	0.19	733	14.5	1.9	81
141 and over, ...	2308	2.79	1693	2.04	0.16	826	16.9	2.0	84
	$1726	$2.34	$1301	$1.76	$0.21	737	14.1	1.9	$81

* Not including operator's labor.

TABLE 17

Relation of Production per Hen to Receipts on 150 Poultry Farms in New Jersey

EGGS PER HEN	Total Receipts		Egg Receipts		Receipts from Fowls Sold Per Flock	Receipts from Crops Sold Per Farm	Receipts Above Expenses	
	Per Farm	Per Bird	Per Farm	Per Hen			Per Farm	Per Bird
60 or less, ...	$1144	$2.20	$680	$1.30	$342	$78	$95	$0.17
61 to 80, ...	1733	2.50	1260	1.90	383	74	286	.42
81 to 100, ...	2050	3.10	1549	2.30	465	36	629	.94
101 to 120, ...	3009	3.70	2302	2.90	663	30	1127	1.43
121 to 140, ...	3415	4.60	2458	3.40	767	144	1578.5	2.15
141 and over, ...	4540	5.50	3408	4.20	1045	70	2232	2.70
	$2818	$3.82	$2100	$2.90	$636	$62	$1092	$1.48

if production were increased too much, the increased cost might equal or exceed the receipts from increased production. The feed cost per bird increased from $1.48 to $2.04, a difference of over 25 per cent. The feed cost per dozen eggs decreased

from 40 cents to 16 cents, or 60 per cent. Thus while the cost per bird increased, the cost per dozen eggs decreased two and two-fifths times as fast. But the decrease in cost per dozen was

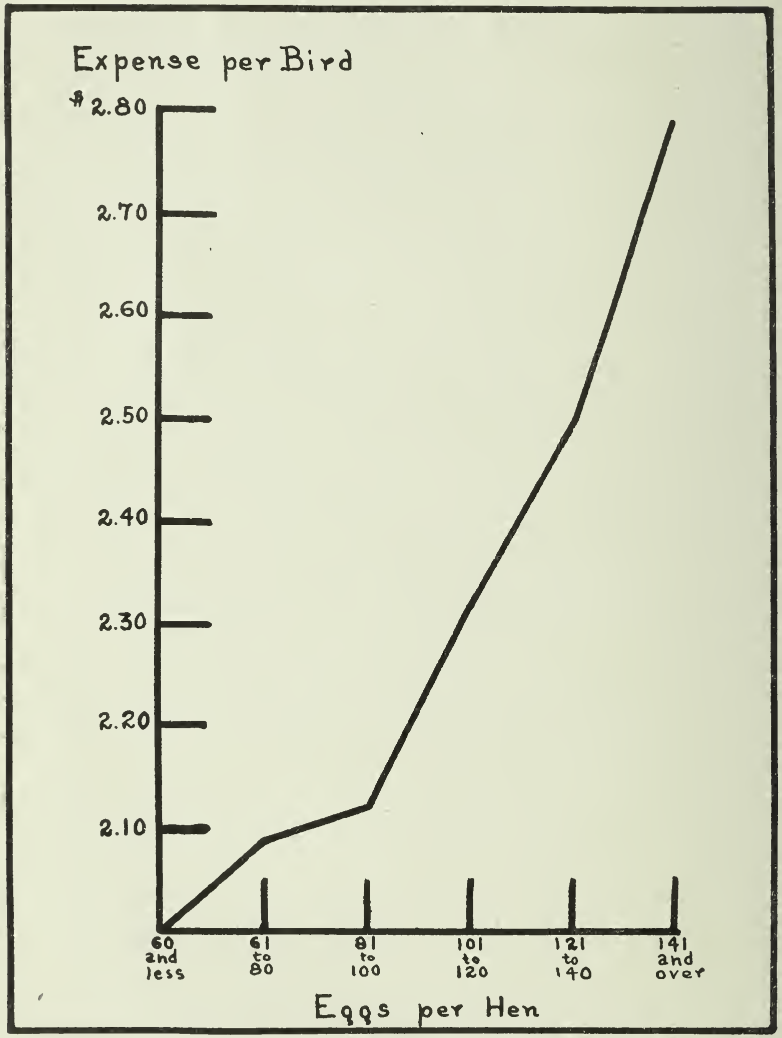

Fig. 9. Relation of Production per Hen to Expense per Bird on 150 Poultry Farms in New Jersey.

far less rapid for the higher-producing classes. The first increase in production made a difference of 10 cents per dozen less, while the last increase made a difference of only 3 cents less

than that of the preceding class. Were a much higher increase attempted, the cost per dozen of eggs might have increased. Feed was not the only item of increased cost for high production, as more labor was required. If we eliminate the flocks that produced less than 60 eggs per hen, we find that the cost of labor

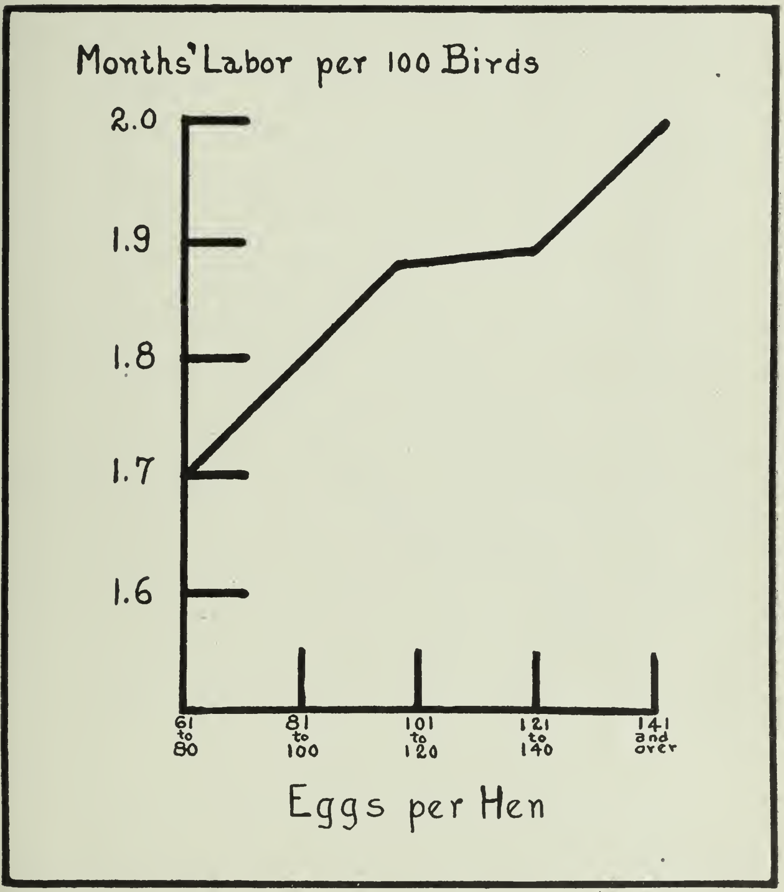

Fig. 10. Relation of Production per Hen to Months' Labor on 150 Poultry Farms in New Jersey.

increased from $72 per 100 hens, for the 68-egg class, to $84 for the 155-egg class, or an increased cost of $12 per 100 birds. This includes only current expenses. To get the total cost would require the difference in the amount of capital invested in equipment, buildings and stock. The feed cost in these flocks was only about half the total cost of egg production.

The receipts per farm were \$2,818, or \$3.82 per bird (table 17). The receipts for the highest-producing birds were two and one-half times as great as for the lowest producers, while

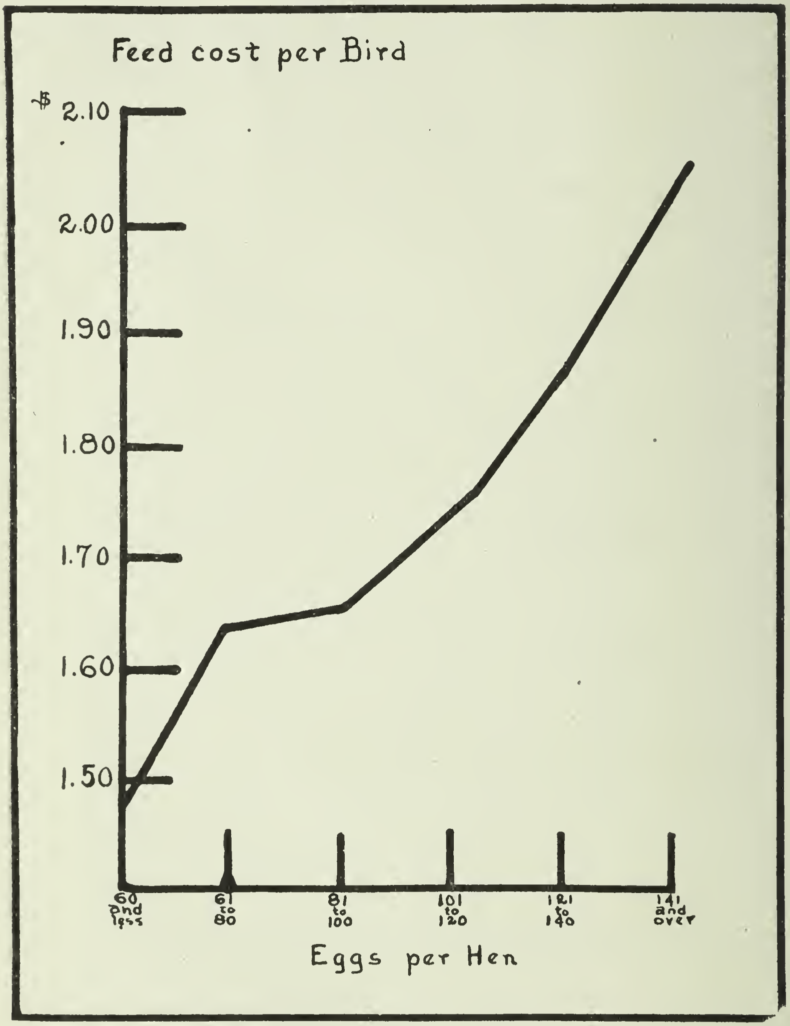

Fig. 11. Relation of Production per Hen to Feed Cost per Bird on 150 Poultry Farms in New Jersey.

the expenses increased only 39 per cent. The proportionate increase of egg receipts was greater than that of the total receipts. The amount of the receipts above expenses was \$0.17 for the

lowest producers and $2.70 for the highest producers. If interest and the operator's labor were charged, the poultrymen having these low producers would be losing money. Not until they got

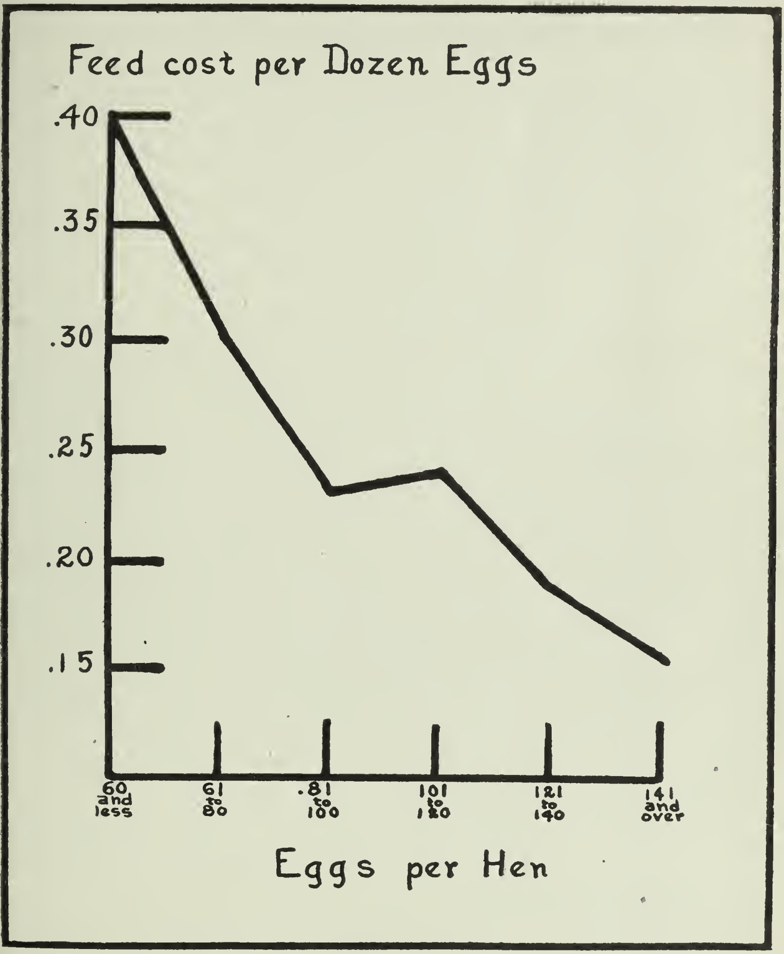

Fig. 12. Relation of Production per Hen to Feed Cost on 150 Poultry Farms in New Jersey.

about 90 eggs per hen did they have wages for their labor and interest on their capital invested. Production above this point brought profits.

With the present cost of feed this production would need to be raised, since the margin of profit per bird is less on the bird of average production. Probably it would require a flock with

a yearly production of 108 to 120 eggs per bird to make wages and interest on the investment. Production greater than this

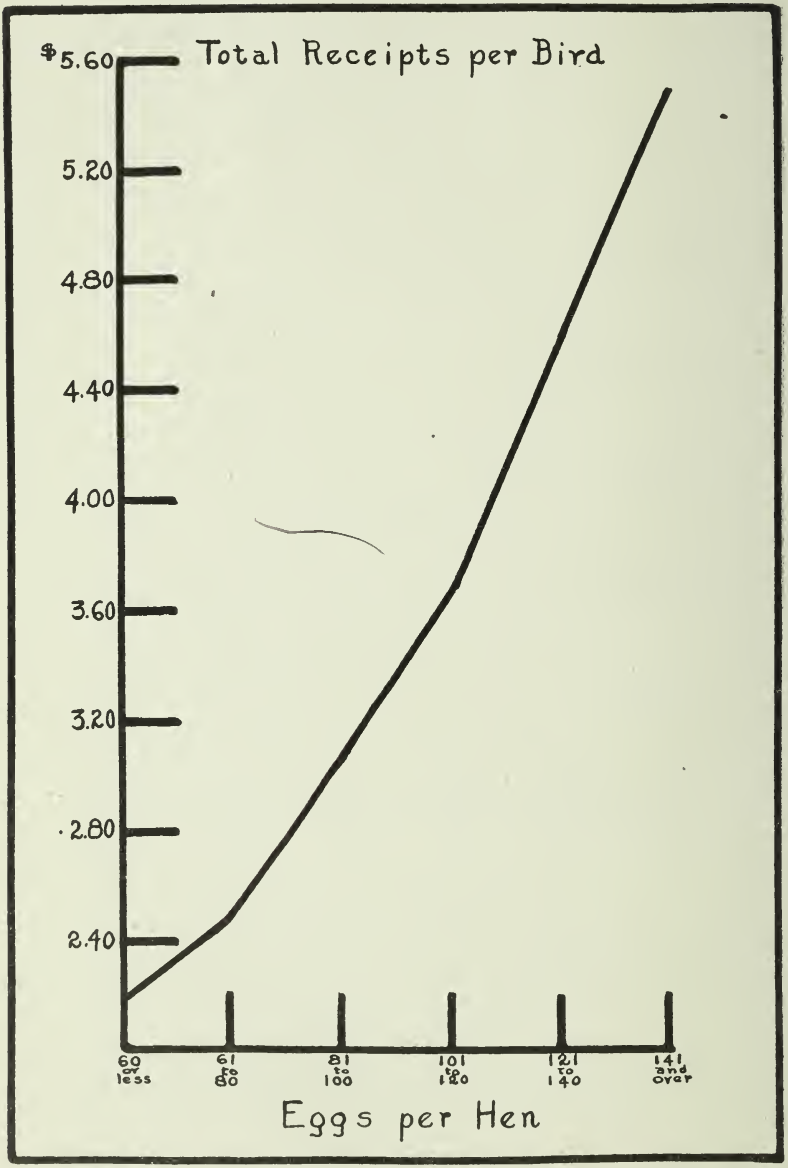

Fig. 13. Relation of Production per Hen to Receipts on 150 Poultry Farms in New Jersey.

would bring profits. Consequently, at no other time has production per hen commanded such a high premium as the present

with the high price of feed. Low-producing flocks will be forced out of existence, because the owners cannot afford to keep such hens.

Relation of Production to Investment

The public seldom stops to consider that increased production of livestock usually calls for increased investment of capital in buildings, equipment and stock. Such, however, is almost invariably the case. Table 18 shows the extent to which this principle applies to poultry.

TABLE 18

Relation of Production to Building, Equipment, Real Estate Investment and Value per Bird on 150 Poultry Farms in New Jersey

EGGS PER HEN	Total Capital Per Farm	Real Estate Per Farm	Poultry Value		Value of Poultry Equipment		Floor Space Per Bird	Value of Poultry Buildings		Acres of Range	
			Per Flock	Per Bird	Per Farm	Per 100 Birds		Per Farm	Per 100 Birds	Per Farm	Per 100 Birds
							sq. ft.				
60 or less, ...	$5431	$4211	$773	$1.45	$256	$31	4.2	$941	$17.9	5.2	1.0
61 to 80, ...	7067	5712	882	1.28	123	18	3.7	1029	14.9	2.9	0.4
81 to 100, ...	6331	4986	829	1.24	153	23	3.9	973	14.6	3.3	0.5
101 to 120, ...	7415	5710	1057	1.32	226	28	3.6	1131	14.1	2.9	0.4
121 to 140, ...	8109	6233	983	1.34	260	35	4.0	1227	16.7	3.7	0.5
141 and over, ...	8189	5819	1223	1.48	340	41	5.0	1511	18.2	3.3	0.4
	$7243	$5572	$981	$1.31	$230	$31	3.9	$1135	$15.4	3.3	0.45

The total capital per farm increased from $5,431 to $8,189 with the increase in production. The value of the poultry itself is greater per bird. Among the lowest-producing birds there was a larger proportion of pullets, increasing the value per bird in these flocks more than that of the normal. In spite of this, however, the value is not quite so high as that of the highest producing hens. It is natural that birds bred for high egg production should be valued more highly than the low producers.

The investment in poultry equipment increased from $18 per 100 birds with the 68-egg hens, to $41 per 100 birds with the 148-egg hens. The building value for these same classes increased from $14.90 to $18.20. The range area is about the

same for both classes, but the floor space in buildings is somewhat greater for the high producers.

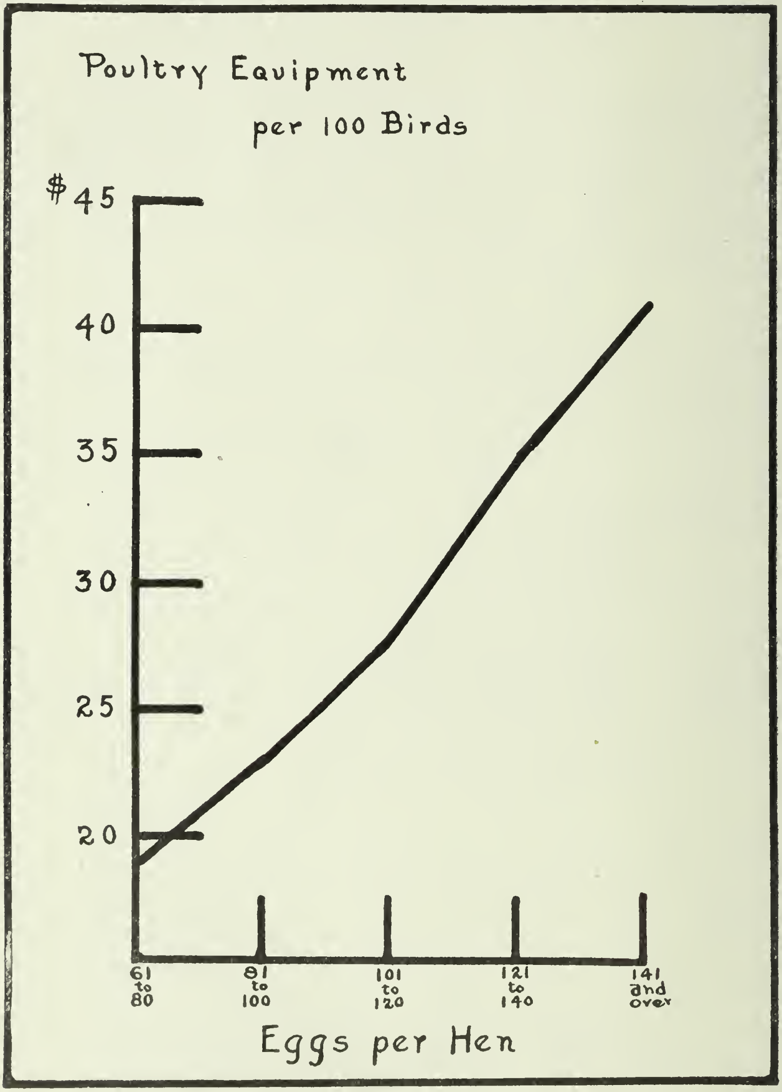

Fig. 14. Relation of Production per Hen to Poultry Equipment on 150 Poultry Farms in New Jersey

Relation of Production to the Experience of the Operator

Low production per hen may be due to the inexperience of the operator as well as to careless methods. For the class of

hens laying the lowest number of eggs this appears to be the case, but this is the only class that is influenced by the operator's inexperience. Consequently, the variation in production of the other classes of farms is due to breeding and methods of operation not influenced by the lack of experience, but rather to the lack of good care and lack of study for profitable production. The influence of experience on profits and other phases of poultry raising is discussed in the following section.

Table 19

Relation of Production to Experience of the Operator and Proportion of Flock as Pullets on 150 Poultry Farms in New Jersey

EGGS PER HEN	No. of Farms	Hens Per Flock	Yearlings Per Flock	Pullets Per Flock	Per Cent. Pullets	Years' Experience of Operator
60 or less,	9	505	109	396	78.4	2.3
61 to 80,	13	673	275	398	59.1	6.2
81 to 100,	32	650	254	396	60.9	5.8
101 to 120,	53	785	310	475	60.5	9.2
121 to 140,	27	717	285	432	60.2	5.5
141 and over,	16	808	305	503	62.2	5.4
	150	719	277.8	442	61.4	6.7

Experience

In all lines of work experience is a great asset. Too frequently the man who contemplates a change of life and work from the city to the farm fails to appreciate the importance of experience. The "would-be" farmer may have spent his boyhood vacation on some relative's farm, or may have observed farming while traveling through the country. From his observations, he usually feels that farming is an industry in which almost any one can readily succeed. For most types of farming it is quite otherwise. Because of lack of experience, not many city people, who were city bred, succeed in farming operations. One great difficulty of this change is that the city man is not accustomed to manual labor. A baseball player learns to throw a ball in his youth. At that time it is easier to acquire such skill. The same kind of skill is necessary for the farmer. He too acquires it in his youth working on his father's farm.

Poultry farming presents a somewhat different problem. Feeding and caring for hens does not require quite the same kind of skill as plowing, pitching hay, driving a team and operating farm machinery. Consequently, this type of farming is far easier for the city man to acquire. A study of the history of these poultrymen informs us that most of them have entered the industry without previous experience. In the Vineland area, 40 per cent of those who took up poultry farming failed and returned to the city, while the other 60 per cent remained and were successful after a few years' experience. When we compare this with the proportion of failures in business in the city, it is not so large. It appears that poultry farming lends itself well for the city man who wishes to make a living in the country.

This is due to a number of factors:

1. Poultry raising is the type of farming that lends itself best to the inexperienced man in acquiring the necessary experience.
2. Less capital is required for poultry farming.
3. Poultry appeals more strongly to the city-bred man.

Former Occupations of Poultrymen

The following occupations were followed by poultrymen included in this survey before they were engaged in poultry farming:

Shopmen (moulders), sailor, salesman, common laborer, bookkeeper, foundry worker, teachers, iron workers, glass workers, chemical engineers, decorator, accountant, postmaster, saloon keeper, carpenter, hackmen, produce commission merchant, contractor, railroad engineer, draughtsman, photographer, restaurant keeper, shoeman, musician, soldier.

Relation of Experience to Profits

If experience is of value it should show in the profits on these poultry farms when they are classified according to the experience of the poultryman. Real estate men interested in selling poultry farms are at times inclined to under-rate the value of experience to a city-bred man who is considering a change from his position in the city to a poultry farm in the country. He may

tell his prospective purchaser that the purchase of the farm and flock will assure the poultryman a steady, sure and regular income for life. The novice may think that the major part of his work will be merely to feed his fowls and gather the eggs. Table 20 shows the fallacy of such belief and strongly emphasizes the value of experience. Still, though handicapped by lack of experience, poultrymen who had been in business one to two years made a labor income of $362, a fair laborer's wage, while learning the business.

TABLE 20

Relation of Experience on the Farm to Profits and Capital on 150 Poultry Farms in New Jersey

YEARS' EXPERIENCE OF OPERATOR	Number of Farms	Capital		Labor Income	No. With Minus Labor Income
		Per Farm	Per 100 Birds		
1 to 2,	11	$6220	$911	$362	3
2.1 to 4,	44	6469	1025	392	11
4.1 to 6,	35	6754	908	720	8
6.1 to 8,	23	7923	911	722	2
8.1 to 10,	13	9202	1101	1002	2
Over 10,	24	8127	1653	1344	1
	150	$7243	$921	$730	27

About one-fourth of all the men who had less than 6 years' experience lost money, while of those who had 8 or more years' experience less than one out of ten was losing money. (Experience was a partial insurance against failure.) The labor income of those who were in the business but 1 to 2 years was $362, while that of the men who had over 10 years' experience was $1344, almost four times as great. The capital was somewhat less for the men who were in the business but a short time. However, the difference was not great enough to make so large a difference in labor income. The capital invested per hundred birds was about the same until the men were in business over 8 years, when it increased.

Relation of Experience to Farm Organization

The poultryman usually does not have his plant so well organized the first few years; he may not be able to operate a large

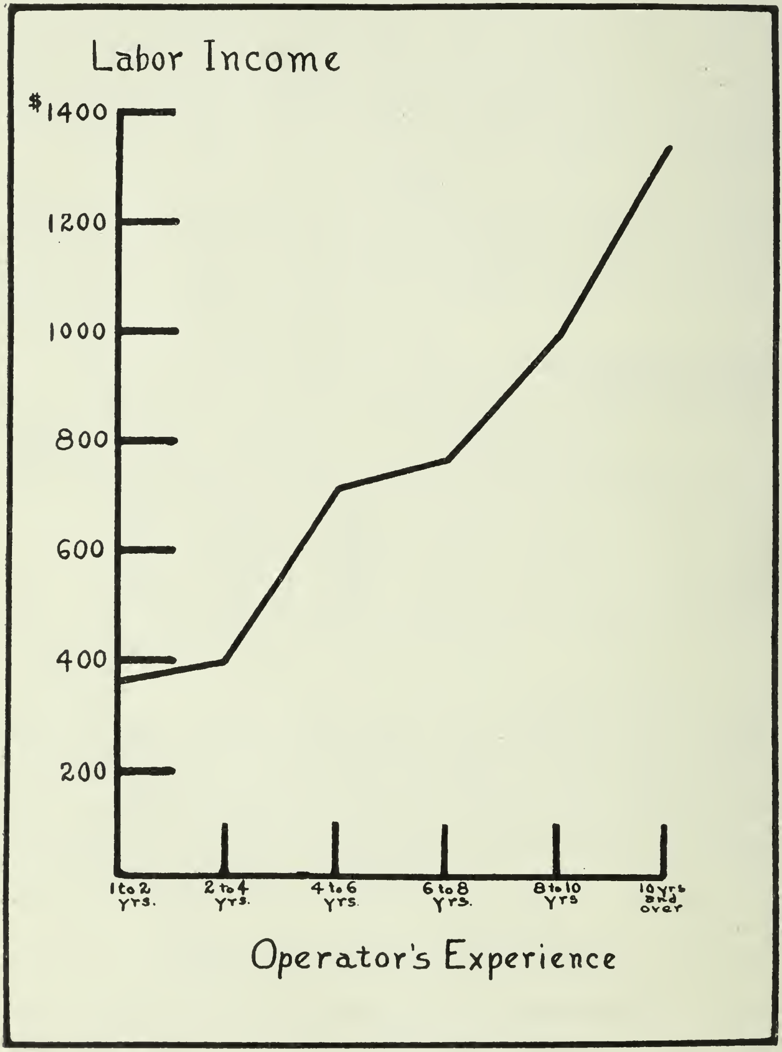

Fig. 15. Relation of Years' Experience to Labor Income on 150 Poultry Farms in New Jersey.

flock, and he may not be sure what is the proper kind of equipment to buy. Table 21 illustrates the way the poultry farm is developed by the amateur poultryman.

Table 21

Relation of Experience of Operator to Organization on 150 Poultry Farms in New Jersey

Years' Experience of Operator	Hens Per Flock	Cockerels Per Flock	Proportion Pullets—Per Cent	Value of Poultry Equipment		Value of Poultry Buildings		Value of Crops Sold Per Farm
				Per Farm	Per 100 Birds	Per Farm	Per 100 Birds	
1 to 2, ...	593	11	65.2	$155	$27	$1110	$163	$134
2.1 to 4, ...	522	11	70.4	181	32	995	158	29
4.1 to 6, ...	663	15	60.1	226	33	878	123	104
6.1 to 8, ...	813	21	55.3	243	29	1276	147	30
8.1 to 10, ...	731	18	65.3	385	51	1452	176	120
Over 10, ...	1075	30	56.	265	24	1430	131	34
	719.8	16.9	61.4	$230	$31	$1135	$145	$62

The amateur started with a flock of 593 birds, and increased up to 1075 after 10 years' experience. He has a larger proportion of pullets and a heavier investment in poultry buildings. Besides this, he tries to grow more crops. As the poultryman gains in experience, he tends to specialize more on poultry, exclusive of all else. He appears to find specialization the most profitable for his business.

The capital is increased (table 20) with experience, but largely through the size of the flock of birds.

Relation of Experience to Receipts and Expenses.

The former data show that experienced operators make greater profits, that they have more capital invested but that the greater profits cannot be due entirely to difference in capital. Apparently they are operating their flocks at a lower cost or getting greater receipts for their efforts and money expended. This is where we might expect the advantage of experience to show largely.

The men who have been in business 10 years or more (table 22) operate their flocks at a lower cost per 100 birds. When the value of the operator's labor is included, the difference is still greater. The labor cost for the 1 to 2-year class is $99.70 per 100 birds, while that of the poultrymen with over 10 years'

experience is only $74.60, a difference of $25.10, or one-quarter less. There also appears to be some difference in the cost of feed per bird. The total farm expenses were greater for the more experienced men, but the expenses per bird in most cases were less.

TABLE 22

Relation of Experience of the Operator to Expenses on 150 Poultry Farms in New Jersey

YEARS' EXPERIENCE OF OPERATOR	*Total Expense		Cost of Labor		Cost of Feed	
	Per Flock	Per 100 Birds	Per Flock	Per 100 Birds	Per Flock	Per 100 Birds
1 to 2,	$1506	$249.30	$602	$99.70	$1129	$187
2.1 to 4,	1318	234.10	493	87.60	999	177
4.1 to 6,	1587	234.00	586	86.40	1189	176
6.1 to 8,	1953	234.10	551	66.10	534	184
8.1 to 10,	2010	268.30	642	85.70	544	206
Over 10,	2406	217.70	824	74.60	1746	157
	$1726	$234.20	$597	$81.00	$1301	$176

* Not including Operators' Labor.

TABLE 23

Relation of Experience to Operator's Receipts on 150 Poultry Farms in New Jersey

YEARS' EXPERIENCE OF OPERATOR	Total Receipts		Poultry Receipts		Egg Receipts		Eggs Per Hen	Receipts Above Expenses Per Bird
	Per Farm	Per 100 Birds	Per Flock	Per Bird	Per Flock	Per Bird		
1 to 2,	$2179	$361	$2045	$2.90	$1471	$2.40	97	$1.12
2.1 to 4,	2036	362	1995	3.10	1467	2.60	99	1.28
4.1 to 6,	2642	390	2225	3.50	1968	2.90	111	1.56
6.1 to 8,	3119	381	3090	3.60	2526	3.10	107	1.47
8.1 to 10,	3472	463	3232	3.90	2305	3.10	124	1.95
Over 10,	4158	376	4106	3.60	3222	2.90	114	1.59
	$2818	$382	$2736	$3.70	$2100	$2.90	109	$1.48

While the expenses increased $900 between the 1 to 2-year class and the class who had been in business over 10 years, the receipts increased $1979, or over twice as much. The receipts per bird were greatest for the 8 to 10-year class; so too were

the receipts above expenses. However, the men in the business over 10 years had larger flocks, which made them the most efficient class for profits, even though their profits per hen were not so high as in the preceding class. These men had a production of 114 eggs per hen, while the 8 to 10-year men had a production of 124 eggs per hen, the highest for any class.

Fifty Years a Poultryman

One poultryman was on his farm for 50 years, longer than any other poultryman in the survey. He had $13,264 invested, of which $10,000 was in real estate, $2314 in stock ($2154 in poultry) $550 in equipment, $200 in feed and $200 in cash. He had 1650 birds. Their production was an average of 108 eggs per hen. The total receipts on this farm were $5306, and the expenses $3193, leaving a farm income of $2113, or a labor income of $1450. This man had a labor expense of $1000 and did but little work himself. From his experience and knowledge he was able to make a comfortable living by directing the work. This man had a record of success that was well worth while.

Pullets vs. Yearlings

Poultrymen usually recommend that the major portion of the flock be made up of pullets in order to be the most profitable producers. The hen lays a larger number of eggs the first year of her life than the second, and a larger number the second year than the third, decreasing the number each year as she grows older. The poultrymen of these farms keep a portion of their flock as yearlings and the remainder as pullets. The best pullets are kept the second year as yearlings and the inferior ones sold. Those sold are selected according to the best judgment of the operator.

Relation of Proportion of Pullets per Flock to Profits

By dividing these flocks according to the proportion of pullets and yearlings, the advantage or disadvantage of keeping a large proportion of yearlings in the laying flock should be shown. Table 24 shows this relation as it existed on these farms.

TABLE 24

Relation of Proportion of Pullets per Flock to Profits on 150 Poultry Farms in New Jersey

PER CENT OF PULLETS LAYING IN FLOCK	Number of Farms	Pullets Per Farm	Yearlings Per Farm	Cockerels Per Farm	Per Cent of Pullets	Birds Per Farm	Labor Income
50 or less.	19	276	475	19	37	771	$511
50.1 to 60,	37	450	405	19	52	874	1034
60.1 to 70,	36	556	309	23	64	888	1062
70.1 to 80,	32	470	172	16	73	659	445
80.1 to 90,	12	412	83	8	83	503	430
90.1 to 100,	14	312	00	4	100	316	272
	150	442	278	17	61	737	$730

The most profitable flocks contained 50 to 70 per cent of pullets. Consequently, according to these data the flock to be properly balanced should have 30 to 50 per cent of yearlings.

Relation of Proportion of Pullets per Flock to Receipts and Expenses

Whether a flock of all pullets or nearly all pullets does not lay so well, or whether they produce eggs at a greater expenditure of feed and labor, would probably determine the reason for a greater profit for the farms having only 50 to 70 per cent of pullets. Table 25 shows why these flocks are more profitable. This is one of the important factors for the successful poultryman and should be fully appreciated.

The poultrymen whose flocks have 50 to 70 per cent of their number in pullets obtain greater total receipts per flock and per hen than any other class. They also receive the highest number of eggs per hen, except the class having 80 to 90 per cent of their flock in pullets. A well balanced flock must carry 30 to 50 per cent of yearlings to produce eggs for hatching. Otherwise, the poultryman will need to buy his eggs for hatching. This allows the development of a better flock, with good vitality and enough old hens to give it stability. The average proportion of pullets on these farms was 61 per cent. They have just about the right proportion on the average. However, about half of these poultrymen have either too many or too few pullets. Most

of them have too few. The production is cut down by too large a number of old hens. The farms having all pullets had the lowest production. Part of this low production may have been

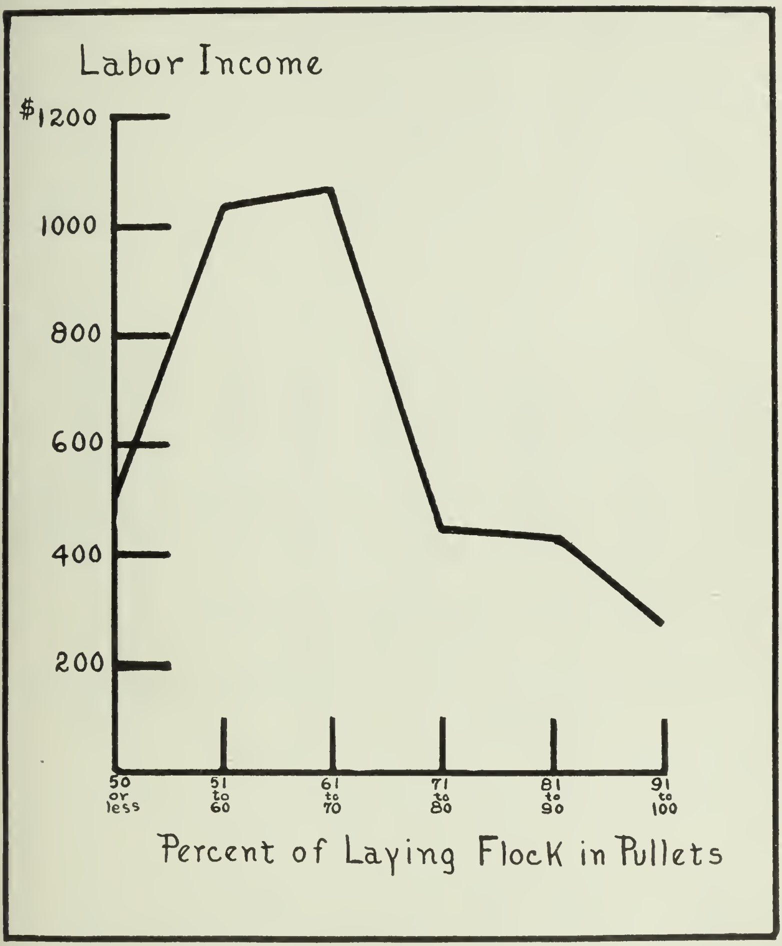

Fig. 16. Relation of Proportion of Pullets per Flock to Labor Income on 150 Poultry Farms in New Jersey.

due to the inexperience of the operator. Table 22 shows that these all-pullet farms were operated by men who had an average of 2.6 years' experience.

With the different proportions of pullets, the expenses remain about the same except for the class of poultrymen whose flocks are made up entirely of pullets. For these the expense is unduly increased, because they are raising proportionally more young stock than the operators of other farms.

TABLE 25

Relation of Proportion of Pullets per Flock to Receipts on 150 Poultry Farms in New Jersey

PER CENT OF PULLETS PER FLOCK	Total Receipts		Total Poultry Receipts		Egg Receipts		Dozen Eggs Sold	
	Per Farm	Per Bird	Per Flock	Per Bird	Per Flock	Per Hen	Per Farm	Per Hen
50 or less,	$2571	$3.30	$2490	$3.20	$2042	$2.70	6162	8.2
50.1 to 60,	3397	3.90	3326	3.80	2624	3.10	7832	9.1
60.1 to 70,	3506	3.90	3409	3.80	2638	3.40	7711	8.9
70.1 to 80,	2297	3.50	2241	3.40	1689	2.60	5120	8.0
80.1 to 90,	2239	4.50	2106	4.20	1525	3.10	4496	9.1
90.1 to 100,	1540	4.90	1455	4.60	845	2.70	2398	7.7
	$2818	$3.82	$2736	$3.70	$2100	$2.90	6238	8.6

TABLE 26

Relation of Proportion of Pullets per Flock to Expenses on 150 Poultry Farms in New Jersey

PER CENT OF PULLETS PER FLOCK	Total Expenses		Labor			Cost of Feed		
	Per Farm	Per Bird	Months Per Farm	Months per 100 Birds	Cost Per 100 Birds	Per Flock	Per Bird	Per Dozen Eggs
50 or less,	$1688	$2.20	14.7	1.9	$80.20	$1297	$1.68	$0.20
50.1 to 60,	2009	2.40	15.3	1.7	71.70	1527	1.74	.19
60.1 to 70,	2060	2.30	15.3	1.7	71.70	1566	1.76	.20
70.1 to 80,	1481	2.20	12.2	1.9	80.20	1111	1.68	.21
80.1 to 90,	1402	2.00	14.7	2.9	122.40	974	1.93	.21
90.1 to 100,	1102	3.50	11.4	3.6	151.90	751	2.37	.31
	$1726	$2.34	14.1	1.9	$81.20	$1301	$1.76	$0.21

Relation of Proportion of Pullets per Flock to Capital Invested and Experience

Since the men included in this survey had such different proportions of their flocks in pullets, it is possible that their capital

and methods of investing their capital varied in a similar way. Table 27 shows that the total capital on these farms is about the same, except for farms having all pullets at the beginning of the year. The value of the real estate is about the same for all but the farms having nothing but pullets. The value of the poultry equipment is greater on the farms where 50 to 70 per cent of the flock are pullets, while the number of birds per flock decreases as the proportion of pullets increases.

TABLE 27

Relation of Proportion of Pullets per Flock to Capital Invested and Operator's Experience on 150 Poultry Farms in New Jersey

PER CENT OF FLOCK IN PULLETS	Capital Per Farm	Value of Real Estate Per Farm	Number of Birds Per Farm	Value of Poultry Equipment Per Farm	Years' Experience of Operator
50 or less,	$7418	$5816	771	$202	9.5
50.1 to 60,	7086	5151	875	276	7.6
60.1 to 70,	7658	5700	888	259	6.0
70.1 to 80,	7442	5992	659	205	7.8
80.1 to 90,	8138	6750	503	194	4.1
90.1 to 100,	5124	4050	316	163	2.6
	$7243	$5572	737	$230	6.7

Men who have less than 50 per cent of pullets have been in the business over 9.5 years, while those who have nearly all pullets have been in the business only 2.6 years. The man with least experience and a small flock evidently keeps more pullets because he is increasing the size of his flock and that is usually done by raising more. As his flock increases he decreases the proportion to 50 per cent or more. Some of these men have too large a proportion of old hens for the maximum profits. As shown above, the properly balanced flock should have 50 to 70 per cent of pullets to give the highest egg production, allow the sale and use of hatching eggs, and maintain the vigor of the flock.

Area of Poultry Farms

Poultry can be kept in quite close quarters without much apparent injury to the egg-producing ability or vitality of the

flock. Because of this fact, the man who wishes to invest but little capital in farming can buy a home with 5 to 20 acres of land, and after erecting his poultry building and laying out his yards and ranges, he is equipped for the poultry business. In spite of the fact that the poultry industry has been studied for years, we still have no data which show conclusively that a hen should have a certain amount of space for range or yard in order to lay the greatest number of eggs. The average size of these poultry farms was 11.6 acres. The smallest farm contained 1 acre, and the largest 150 acres. This is a wide range, but the most important point is to determine the area per 100 hens that is best for the production of eggs and the vitality of the flock. This might be expressed in terms of profit, eggs produced per hen, deaths per 100 hens or in other ways.

Relation of Area to Profits and Capital

When expressed in terms of labor income or profit, there does not appear to be any area too small for the most profitable pro-

TABLE 28

Relation of Area per 100 Birds to Profits on 150 Poultry Farms in New Jersey

ACRES PER 100 BIRDS	No. of Farms	Area Per Farm	Area Per 100 Birds	Crop Acres Per Farm	Capital Per Farm	Real Estate Value			Labor Income
						Per Farm	Per Acre	Per 100 Birds	
		Acres	Acres						
0.5 or less,	26	3.6	0.4	1.3	$7203	$5473	$1564	$651	$1056
0.6 to 1.0,	47	6.7	0.9	2.4	7128	5550	828	492	663
1.1 to 2.0,	43	11.4	1.5	4.6	7257	5541	489	745	743
2.1 to 3.0,	16	16.6	1.8	6.8	7532	5937	360	947	350
3.1 and over,	18	32.5	4.9	12.7	7293	5567	171	540	734
	150	11.6	1.6	4.6	$7243	$5572	$480	$756	$730

duction on these farms. The farms having the smallest area per 100 birds had a greater acre value. This is largely true throughout the Vineland area where land values were greater than in some of the other areas. The operators of some of these farms were paying for location and buildings rather than land. There

were 26 farms on which the farm area for their chickens averaged only 3.6 acres (table 28). In spite of their small area they had the largest labor income of all classes.

The capital invested per farm was about the same regardless of the area. It appears that location and buildings are the major consideration in the purchase of one of these poultry farms. Close confinement of birds has not decreased profits or appreciably affected them. This is another advantage for the poultry industry, and should encourage the keeping of village and town flocks.

Relation of Area to Production, Receipts and Expenses

If the small areas of some of these flocks were injurious to the health of the fowls, we would expect a lower egg production, less receipts per hen and a larger percentage of deaths. If these factors do not decrease it would appear that 3.6 acres per 100 birds are sufficient to maintain their health, vigor and production under the soil and climatic conditions of the areas studied.

TABLE 29

Relation of Area per 100 Birds to Egg Production, Receipts per Hen and Per Cent of Mortality on 150 Poultry Farms in New Jersey

ACRES PER 100 BIRDS	Dozens of Eggs Sold		Total Receipts		Number of Birds Per Flock	Value Per Bird Sold	Years' Experience of Operator
	Per Farm	Per Hen	Per Flock	Per 100 Birds			
0.5 or less,	7274	8.5	$3312	$379	873	$0.25	6.4
0.6 to 1.0	6137	8.6	2705	374	721	.35	5.4
1.1 to 2.0,	6368	8.8	2877	386	743	.37	8.1
2.1 to 3.0.	5185	8.5	2360	376	627	.28	6.3
3.1 and over,	5632	8.7	2667	403	661	.47	7.9
	6238	8.6	$2818	$382	737	$0.32	6.7

The number of eggs sold per bird is about the same regardless of the area per 100 birds, while the same is true of receipts (table 29). The flocks on the farms having the smallest areas are somewhat larger than on those of a greater area. One factor would indicate that these poultrymen are cramped for space when

we study the price received per bird sold. Those on the smaller areas sold the young cockerels when 3 to 6 weeks of age, that is, as soon as they can distinguish them, for the very low price of 10 to 20 cents apiece. The poultrymen having larger areas kept more of them until older, when they were sold for broilers. If the space would have permitted, probably it would have paid all of these men to feed and fatten their own cockerels instead of selling them to some one else to fatten.

TABLE 30

Relation of Area Per 100 Birds to Expenses on 150 Poultry Farms in New Jersey

ACRES PER 100 BIRDS	Total Expenses		Feed Cost		Labor		Cost Per 100 Birds	Per Cent of Deaths of Mature Birds	Amount of Receipts Above Expenses Per Bird
	Per Farm	Per 100 Birds	Per Flock	Per 100 Birds	Months Per Flock	Months Per 100 Birds			
0.5 or less, ...	$1815	$216	$1488	$161	13	1.49	$61.70	6.6	$1.63
0.6 to 1.0, ...	1685	236	1298	178	14.1	1.94	81.80	5.1	1.28
1.1 to 2.0, ...	1771	238	1343	170	13.8	1.86	78.30	7.3	1.48
2.1 to 3.0, ...	1635	260	1215	193	14.5	2.33	97.60	11.6	1.16
3.1 and over, ...	1567	237	1044	157	16.4	2.48	105.50	9.0	1.66
	$1726	$234	$1301	$176	14.1	1.92	$81.20	7.1	$1.48

The expenses in these flocks do not appear to be greatly influenced by the area of the poultry farm (table 30). The only item which shows any difference is that of labor. Flocks on the smaller areas are kept at a smaller cost of labor per bird. To some extent this would be influenced by the size of the flock, but the difference in size was not sufficient to make such a great difference in labor cost. Evidently, flocks kept on a smaller area require less labor to care for them.

The death rate is not quite so great for the flocks on the smaller areas. If the small amount of range allowed these flocks were detrimental, it should show in the death rate. They were fully as healthy as those on the more extended ranges. For an area such as Vineland, diseases prevalent in one flock are much inclined to spread throughout the entire community because of the close proximity of these farms. This is a marked disad-

vantage for an intensive poultry district such as that of Vineland.

The feed cost per bird is about the same regardless of the area. Although there is some variation, it does not appear to show much, if any, difference due to difference in area.

From these data it appears that chickens can stand close confinement without injury. Probably the most serious objection to so densely populated a poultry section is the close contact of the individual flocks which makes the spread of contagious diseases dangerous. One of the most troublesome diseases in this section was chicken pox. The year of this survey the area was quite free from the disease, while the following year the disease was quite prevalent. This made the death rate for 1915–16 lower than normal, and gave an egg production about 5 per cent above normal. This disease is most prevalent in the late summer for about six weeks, when the production is cut to about 50 per cent.

MONTHLY EGG PRODUCTION AND PER CENT OF TOTAL RECEIPTS PER MONTH

Hens lay the major portion of their eggs during March, April, May, June and July. Consequently, at this time of the year the

TABLE 31

Relation of Month of the Year to Egg Production and Receipts per Flock on 36 Poultry Farms

MONTH	Receipts Per Cent	Production Per Cent
January	7.7	6.5
February	7.8	8.5
March	10.0	12.8
April	10.4	14.1
May	10.3	13.7
June	9.4	11.3
July	9.7	9.7
August	9.1	7.6
September	6.9	4.9
October	5.4	3.1
November	5.5	3.2
December	7.1	4.3
	100.0	100.0

poultry receipts are higher than during other portions of the year. However, the price of eggs will vary with the time of the year so

as to encourage a greater production during the months from August to March.

By hatching early chicks this production can be modified so as to give a larger egg yield while the higher prices for eggs prevail.

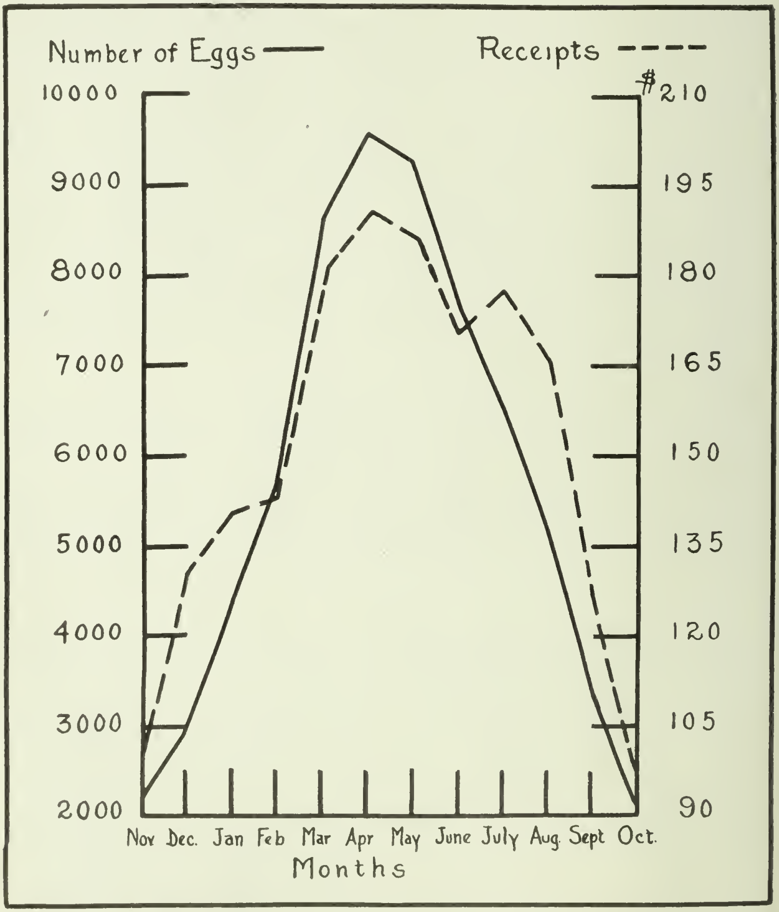

Fig. 17. Monthly Egg Production and Gross Receipts per Farm.

Table 31 shows the per cent of egg production for the year by months as well as the per cent of receipts for the year by months.

From figure 18 it will be noticed that if the high point of egg production could be shifted from the spring months so as

to make a more even distribution of production, the poultrymen would have better profits for the entire year.

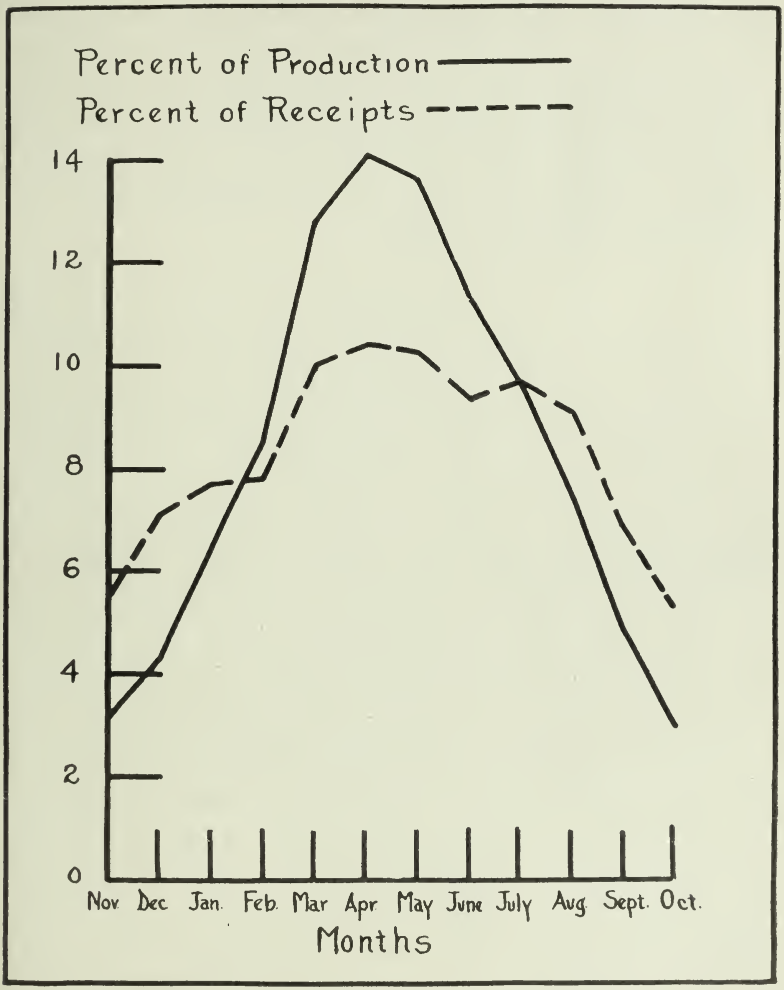

Fig. 18. Per cent of Total Yearly Egg Production and Total Yearly Egg Receipts by Months per Farm.

COST OF EGG PRODUCTION

By separating the poultry farms on which nothing but poultry products were sold we can figure the cost of producing eggs on commercial poultry farms. There were 100 such farms.

Since the raising of young stock was always a part of the business it would appear proper in this case to include the cost of maintaining the farm flock in calculating the cost of commercial egg production. For most kinds of livestock this would not be desirable, but on these poultry farms it appears more satisfactory.

On November 1, 1915, there were on these 100 farms 75,898 birds, of which 1,864 were cockerels (table 32). The cockerels were considered the same way as the hens in reckoning the costs per bird. Also the total cost per bird includes the cost of raising young stock to maintain the flock.

TABLE 32

Number and Value of Birds on 100 Poultry Farms from which only Poultry Products were Sold

	Beginning of Year Nov. 1, 1915		End of Year Nov. 1, 1916	
	Number	Value	Number	Value
Pullets,	46,509	$69,921	50,274	$74,856
Yearlings,	27,525	30,433	31,390	35,822
Cockerels,	1,864	3,818	2,333	4,858
Total,	75,898	$104,172	83,997	$115,536
Value per bird,	$1.37		$1.37	

While the number of birds had increased at the end of the year, the laying flock was considered as the number of hens at the beginning of the year. While this is subject to slight error, it appeared nearer to the correct number than any modification of this number that might be made to allow for this increase. Some of the birds (7.1 per cent) inventoried at the beginning of the year died, while still others were culled out before the end of the year. The increased number of pullets and yearlings at the end of the year would approximate the loss from the first inventory.

Depreciation of Hens

The depreciation of the birds is an item of much importance and should be carefully considered in holding over pullets and yearlings. A hen has a meat value and a laying value. The

latter is potential and will almost always be greater than her meat value. Consequently, as hens grow older they decrease in potential egg-laying value and approach their meat value.

TABLE 33

Depreciation of Pullets and Yearlings on 100 Poultry Farms in New Jersey

KIND OF CHICKEN	Value Per Bird	Depreciation Per Bird at End of Year	Per Cent Depreciation Per Bird
Pullet,	$1.53	$0.42	29
Yearling,	1.11	.56	50
Two-Year-Old,	.55	.....	..

By the time these pullets become two-year-old hens and are sold for meat, they depreciate from $1.53 to $0.55, or 64 per cent (table 33). During the first year of the pullet's life, she depreciates from $1.53 to $1.11, or 29 per cent. In the second year she depreciates from $1.11 to $0.55, or 50 per cent, when she is sold for her meat value. The death rate would further enter into this depreciation, but this presumably would be approximately the same for both pullets and yearlings.

Inasmuch as the yearlings depreciate $0.14 per hen more than pullets, it appears that they should lay 5.7 eggs more per hen (when eggs sell for 33.9 cents per dozen) than pullets in order to be as profitable as the latter. This would be true were it not necessary to have a certain proportion of yearlings in the flock to act as a stabilizer and for breeding stock. Beyond the number necessary for that purpose no yearlings should be kept in the place of pullets. They lay fewer eggs per hen and depreciate more rapidly. However, if pullets at the end of the year had to be sold for their meat value, then their depreciation would be 64 per cent, or $0.98. In that case they would need to lay 2.9 dozens more (when eggs are selling at 33.9 cents per dozen) than a 55-cent hen in order to make the same profit.

Itemized Costs and Receipts

The cost of egg production in 1916 expressed in dollars and cents would not be the same as in 1917 or 1918 when prices of feed, labor and materials have changed. But the amount of feed

TABLE 34

Cost of Egg Production on 100 Poultry Farms in New Jersey

Number of Chickens November 1, 1915 75,898
Number of Chickens November 1, 1916 83,997

	Quantity		Value			
	Total	Per Bird	Total	Per Bird	Value Per Bird 1917-18	Per Cent Increase in 1917-18 Over 1915-16
Grain,	63,346,060 lbs.	82.97 lbs.	$131,052.00	$1.726	$3.44	100
Succulent Forage { Beets,	13⅔ A. (159¾ T.)	.002 T.	958.50	.012	.018	50
Succulent Forage { Cabbage,	4 A. (24650 h. at 2c.)	324 h.	431.38	.005	.007	40
Human Labor,	1116½ mo.	.014	47,116.30	.620	.924	50
Hired Labor,	227.6	.003	9,606.42	.126	.186	50
Horse Labor,	486 days	.006	2,431.00	.032	.048	5
Litter and Use of Range, $128,367 at 6%,	....	....	7,702.00	.101	.101	.....
Seed for Range,	....	....	711.00	.009	.01	10
Use of Building—Depreciation at 10%,	....	....	11,787.00	.155	.225	50
Interest on Buildings at 6%,	....	....	6,866.00	.090	.10	10
Use of Equipment—$23,313 at 12.95%,	....	....	3,019.00	.039	.078	50
Interest on Equipment—$23,313 at 6%,	....	....	1,399.00	.018	.020	10
Interest per Hen—$100,354 at 6%,	....	....	6,020.00	.081	.097	20
Use of Cockerels,	1,864	.025	7,176.40	.097	.105	20
Hatching Eggs Used,	*335,338	4.41	9,768.40	.128	.161	25
Hatching Eggs Bought,	33,400	.44	973.00	.0128	.016	25
Day-old Chicks Bought,	9,100	.119	1,311.00	.017	.021	25
Pullets Bought,	5,103	.067	1,005.00	.013	.016	25
Yearlings Bought,	851	.011	910.00	.012	.014	20
Cockerels Bought,	17	.0002	17.00	.0002	.0002	25
Custom Hatching,	....	....	70.00	.0009	.001	10
Crates Cost,	....	....	1,840.00	.024	.036	50
Spray Materials,	....	....	651.50	.008	.01	25
Deaths,	5,323 at 7.1%	....	7,513.90	.099	.118	20
Fuel and Oil,	....	....	2,314.00	.030	.037	25
Depreciation,	75,898 at 36%	....	37,721.31	.497	.621	25
Total,			$300,371.11	$3.953	$6.41	†62.2

*Cost $0.02912 per egg.
†Per cent increase in cost of keeping hen per year.

and labor as well as other materials and items expressed in quantities always remain about the same regardless of price. Consequently, in making up the items entailed in the cost of production the quantities are more important and the values can be placed upon these quantities as the prices would vary or warrant. For a few minor items the quantities were not obtained and these had to be expressed in terms of money. But for most of them the quantities are given, with the value for 1916 (tables 34 and 35).

TABLE 35

Receipts from 100 Poultry Farms in New Jersey

Number of Chickens November 1, 1915 75,898
Number of Chickens November 1, 1916 83,997

	Quantity		Value		Value Per Bird 1917-18	Per Cent Increase 1917-18 Over 1915-16
	Total	Per Hen	Total	Per Hen		
Eggs sold (doz.),	620,827	8.385	$210,463	$2.842	$4.578	62
Eggs used in house (doz.),	14.222	.19	4.811	.064	.104	62
Hatching eggs sold (doz.),	26,682	.36	9,045	.122	.153	25
Day-old chicks sold,	55,239	.746	6,808	.091	.114	25
Manure (bbls.),	16,518	.222	8,001	.108	.162	50
Increased inventory (birds),	8.099	.109	11,364	.153	.191	25
Pullets sold,	11,116	.15	8,200	.110	.137	25
Yearlings and old hens sold,	31,135	.42	17,162	.231	.277	20
Cockerels sold,	61,735	.833	14,064	.189	.236	25
Birds for house use,	5,200	.07	2,860	.038	.052	10
Appreciation,	75,898	.36%	37,721	.497	.621	25
Custom hatching,	....	....	264	.003	.003	....
Total receipts,	926,671	11.846	$330,763	$4.448	$6.628	*49.1

* Increase in earning power of one hen per year.

Total expenses,	$300,371.11
Receipts other than from eggs,	106,444.00
Cost of egg production,	193,927.11
Cost per dozen eggs,	0.293
Man labor per 100 birds,	1.77 months
Pounds of feed per 100 birds,	8,297
Value per bird,	$1.37
Profit per dozen eggs,	.046
Profit per hen,	.41

For each 100 hens possessed by the poultrymen at the beginning of the year, they raised 78.3 to mature birds. Besides these birds raised, 8.84 dozens of eggs were produced per hen with the given materials and labor.

The total quantity of feed consumed was 82.97 pounds per mature bird, which included the amount of feed used for the young stock grown to maintain the flock. For White Leghorn hens of a production such as these, approximately 7 pounds of feed are required per pound of eggs produced in these flocks. The feed cost of these birds was but 44 per cent of the total cost of production. Man labor comprised 19 per cent, loss by death 7.1 per cent, and depreciation 12.3 per cent. The feed cost was not nearly so large as one ordinarily expects it to be. Expressed in terms of labor and feed, it required 70 pounds of grain and 3 hours of labor to feed and care for a hen for a year on these poultry farms, after deducting feed and labor for young stock.

COMPARATIVE EFFICIENCY OF ANIMALS AND POULTRY

The converting of grain and forage into meat for human consumption is a matter of vital importance in the food production of a densely-populated nation. As the nations increase in population, the per capita consumption of meats and animal products gradually decreases because the grain used to produce meat is needed for human consumption. The converting of food from grain into meat is a wasteful process. A hungry man would prefer 10 pounds of corn to 1 pound of beef, or 7 pounds of corn to 1 pound of eggs, or 5 pounds of corn to 1 pound of pork. These are approximately the amounts of corn necessary to produce one pound of the respective meats and eggs. Of all the different animals the dairy cow is the most efficient in converting vegetable food into human food (table 36).

When the return is based upon the per cent of protein returned these types of stock rank as follows from the most to the least efficient:

1. Dairy cow.
2. Poultry.
3. Hog.
4. Steer.

When ranked according to the proportion of energy returned of the production value of food eaten, they rank as follows:

1. Dairy cow.
2. Hog.
3. Steer.
4. Poultry.

Thus in densely-populated centers, dairy cows increase and hogs and steers decrease in proportion to the population. Poultry

TABLE 36*

Proportion of Food Eaten by Various Classes of Livestock that is Returned for Human Use[1]

KIND OF LIVESTOCK	Per Cent of Protein Returned		Per Cent of Energy Returned		
	Of Total Food	Of Digestible Protein	Of Total Food	Of Digestible Food	Of Production Value of Food
Cow,[2]	....	41.0	....	....	48.9
Cow,[3]	....	31.4	....	....	40.6
Dairy herds,[4]	14.7	22.9	10.0	15.1	33.8
Steer,[5]	....	8.9	....	....	17.0
Steer,[6]	6.4	11.8	4.7	6.9	14.8
Hen,[7]	16.1	20.9	7.1	8.3	14.1
Poultry flock,[8]	14.5	18.6	6.4	7.5	12.6
Hogs,[9]	10.2	13.2	15.1	17.5	29.9

[1] Values as human food from U. S. Dept. Agr. Off. Exp. Sta. Bul. 28 (Revised).

[2] A 1000-pound cow giving 6000 pounds of 4 per cent milk based on Armsby's feeding standard. (Armsby, H. P., 1902, Manual of Cattle Feeding, p. 432.)

[3] Similar cow raised to 2 years on Armsby's standard, milked 5 years, then sold as lean beef.

[4] Food eaten by 5191 cows, 1078 heifers, 874 calves, 158 bulls, in Delaware County, New York. Pasture assumed to be one-third of the food. Net product: 24,646,000 pounds of milk, 100,000 pounds of skim-milk, 260 pounds of butter, and 559 cows, 235 heifers, 62 bulls, 9 calves for beef. Most of the calves were killed and thrown away at birth.

[5] Steer grown to 1000 pounds in 2 years, then fattened 200 pounds in 100 days, by Armsby's standard. Meat counted as fat beef.

[6] All food eaten by a steer that grew to 1588 pounds in 3 years, assumed to be fat beef. (Ontario Agr. Col. Rpt. 1893, p. 122.)

[7] Food and product of 1 hen, average of 1893 birds, by Warren.

[8] All feed except grass for an average of 1803 hens and 60 roosters kept one year, 2713 chickens raised. Net product: 204,093 eggs above those used for incubation, 1080 fowls and 1404 cockerels and pullets sold for meat, 4395 pounds. Records kept by Warren.

[9] Hogs assumed to have eaten the same feed as 1 hen and to have made a gain of 1 pound for 5 pounds of grain.

* Eccles, C. H., and Warren, G. F., 1916, Dairy Farming, p. 8.

may increase or decrease, depending upon whether they are raised entirely on grain or partly on refuse and waste around the farm. However, when we study the relative efficiency of stock and fowls in converting grain and hay into meat and eggs, it is

clear why the proportion of these classes of livestock shift as the population of a country increases. The hog and hen, when fed on grain, compete with the human race for food more so than the dairy cow and steer, for the latter use a large proportion of roughage not fit for human consumption. This makes a wider discrepancy than the figures show.

MAJOR FACTORS ESSENTIAL FOR SUCCESS IN POULTRY RAISING

A few pertinent factors were found to be very important in all the successful poultry farms. These factors in the order of their importance were as follows:

1. Size of Flock.
2. Egg Production per Hen.
3. Experience of Operator.
4. Proportion of Pullets to Yearlings.

For these farms the egg production per hen was less important than size and experience. All are necessary for success, but some more so than others. By dividing the farms into three classes, one class having over 720 hens and over 109 eggs per hen, one class having either of these factors (over 109 eggs per hen, or 720 hens per farm), and one class having neither of these qualifications, we can note the effect on profits.

Two Essentials for Success in Commercial Poultry Raising

The two most essential factors in making the poultry business a success proved to be the egg production per hen and the size of the flock. Many other factors are important, but usually when these were correct the others were necessarily so, otherwise these could not have been correct.

TABLE 37

Relation of Two Major Factors—Size of Flock and Egg Production per Hen—to Profits on 150 Poultry Farms in New Jersey

Two Factors—Size and Production—As Good As or Better Than the Average	No. of Farms	Average Labor Income	Highest Labor Income	Lowest Labor Income
Both,	29	$2002	$3413	$354
Either,	72	659	2216	–617
Neither,	49	106	1144	–1013

Poultrymen on whose farms these two factors were as good as or better than the average made a labor income averaging $2002 (table 37). Where neither was as good as or better than the average, the average labor income was $106. The importance of these two points cannot be too strongly emphasized.

POULTRY RAISING COMPARED WITH OTHER TYPES OF FARMING AND THEIR POSSIBILITIES

For the year 1916 poultry farming proved profitable on the commercial poultry farms of New Jersey. These farms were only moderate in size, they were not breeding farms and repre-

TABLE 38

Distribution or Range of Labor Income on Poultry, Dairy, General and Potato Farms in New Jersey

NUMBER OF FARMS HAVING GIVEN LABOR INCOME

TYPE OF FARMING		No. of Farms	Less than $1	$1 to $400	$401 to $700	$701 to $1000	$1001 to $1500	$1501 to $2000	$2001 to $2500	$2501 and over
Poultry,		150	27	40	21	20	20	4	7	11
Dairy	Owners,	300	83	82	41	39	25	16	8	6
	Tenants,	160	19	52	43	18	15	5	6	2
General	Owners,	192	66	41	20	14	25	13	5	8
	Tenants,	68	9	21	11	10	10	4	1	2
Potato	Owners,	194	39	33	26	21	32	13	9	21
	Tenants,	149	12	39	33	21	21	11	10	2
*Truck,		300	97	71	47	32	20	14	7	12

PER CENT OF FARMS HAVING GIVEN LABOR INCOME

TYPE OF FARMING		Less than $1	$1 to $400	$401 to $700	$701 to $1000	$1001 to $1500	$1501 to $2000	$2001 to $2500	$2501 and over
Poultry,		18	27	14	13	13	3	5	7
Dairy	Owners,	28	27	14	13	8	5	3	2
	Tenants,	12	33	27	11	9	3	4	1
General	Owners,	34	21	10	7	13	7	3	4
	Tenants,	13	31	16	15	15	6	2	3
Potato	Owners,	20	17	13	11	16	7	5	11
	Tenants,	7	28	22	14	14	7	7	1
*Truck,		32	24	16	10	7	0	2	4

* Owners and Tenants.

sent a conservative poultry industry. It may be interesting to compare the range of profits of poultry farming, such as these commercial egg farms represent, with that of other types of farming in the state (table 38).

While there is a smaller proportion of poultry farms on which a large labor income is made than the potato farms, there is also a smaller proportion on which the operators are losing money. Compared with the other types of farming, poultry excelled in 1916. At present, with the change of grain and egg prices, as well as other of farm products, this relation would probably be different. However, the poultryman who has kept his two major factors, viz., size of flock and production, above the average, has not suffered much.

SUMMARY

1. New Jersey has some marked advantages pertaining to the poultry industry, especially those of markets, climate, soils and an established business of much reputation.

2. The poultry areas of New Jersey are devoted almost exclusively to poultry raising, without any other line of agriculture important in the areas.

3. Four poultry associations, branches of the state association, flourish in these poultry areas.

4. The flock practice of these commercial poultry farms is quite uniform.

5. The floor space in the laying houses was 3.9 square feet per mature bird.

6. Yearlings are largely kept every winter as breeders for the production of hatching eggs.

7. Eggs are carefully sorted, and those of medium size and uniform shape are used for hatching.

8. Most of the hatching is done by incubators having a capacity of 360 to 400 eggs.

9. Culling of the chickens begins immediately after incubation, and before they are placed in the brooder.

10. Small chicks are fed four times a day for the first week, three times for the next two weeks, and twice a day thereafter.

11. The most common type of brooder house is one 14 to 20 feet in width, and long enough to care for the desired number of chicks.

12. Colony brooder houses are largely used on the newer poultry plants.

13. Few hens are kept after they are two years old.

14. Most young cokerels are separated from the rest of the flock as soon as distinguishable, which is four to five weeks after hatching.

15. The number of pullets and old hens in these flocks on November 1, is considered as the size of the flock for the year.

16. The majority of the poultrymen buy their grains separately and mix them. The ration used is largely that recommended by the New Jersey Agricultural Experiment Station.

17. The ranges for the poultry occupy 3.2 acres per farm, or over 27 per cent of the total farm area.

18. White Leghorn fowls comprise 94.3 per cent of the total number on these farms.

19. These poultry farms received from products other than poultry an average of $62 per farm, largely from fruit.

20. The farms were all occupied by owners.

21. The average labor income for the 150 farms was $730, almost $1.00 per hen.

22. The average capital per farm was $7243.

23. The largest capitalized farms gave the largest profit.

24. The average per cent returned on investment was 15.1 per cent.

25. The average size of these flocks was 737 fowls, of which 720 were hens and 17 cockerels.

26. The largest flocks gave the largest profits per farm.

27. The largest flocks were the most economical to operate.

28. The average building investment was $1.54 per bird.

29. The amount of receipts above expenses, not including the operator's labor, was $1.48 per bird.

30. The average egg production per hen was 109 eggs for the year.

31. The average current expense per hen was $2.34.

32. The average receipts per bird were $3.82.

33. An average of 1.7 months' labor was required to care for 100 mature birds and chickens raised per 100 mature birds per year.

34. The flock with the highest production showed the greatest profit for the year.

35. Eleven per cent of the flocks gave a production of 45 per cent above the average for the 150 farms.

36. Experience was quite necessary to success on these poultry farms.

37. The poultrymen on these farms were engaged in many different lines of work prior to entering the business.

38. The proper proportion of pullets to yearlings was 50 to 70 per cent of the number of the flock.

39. The size of the area per flock did not appear to affect the egg production, or the number of deaths in the flock.

40. The average depreciation of pullets was 29 per cent and of yearlings 50 per cent, while the average depreciation of a pullet until she was sold as a two-year old was 64 per cent.

41. The average cost of producing eggs in 1916 was 29.3 cents per dozen.

42. The average amount of feed required for the laying flock and young stock was 82.97 pounds per hen.

43. The average amount of labor for the laying flock and young stock was only 1.77 months per 100 birds.

44. The average profit per hen on 100 farms was 41 cents.

45. The major factors essential for success on these poultry farms were: (1) size of flock, (2) egg production per hen, (3) experience of operator, and (4) proportion of pullets to yearlings.

46. The two most essential factors were size of flock and production per hen.

47. Poultrymen having flocks whose production and size were above the average made an average labor income of $2002, and those with flocks having only size or production as good as or better than the average received only $659, while those in whose flocks neither size nor production was as good as or better than the average made an average labor income of only $106.

ACKNOWLEDGMENT

The authors take pleasure in acknowledging the courtesy of Dr. J. G. Lipman, dean and director, for his support in the work, and express their appreciation to the poultrymen who gave these data so that the work was made possible.

Mr. A. G. Waller collected the data and assisted in tabulating a portion of the survey. He also wrote the portions of the manuscript devoted to the Description of the Areas, Poultry Associations, Flock Practice, and the Laying Flock. Prof. H. R. Lewis gave his counsel, and read and criticised the manuscript after it was prepared by the senior author, who directed the work, prepared and studied the data and wrote the manuscript except such portions as were written by Mr. Waller.

Fig. 1. Modern poultry plant in the Vineland area, showing buildings.

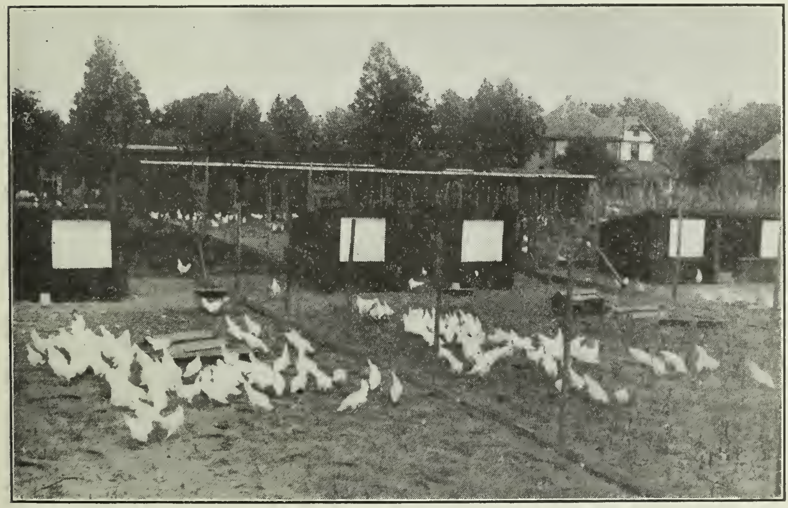

Fig. 2. Modern colony houses with the ranges in the Vineland area.

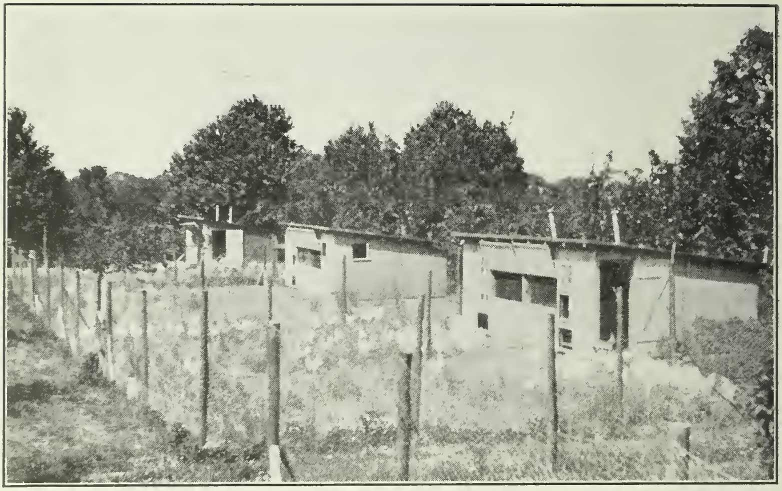

Fig. 1. Typical brooding scene in Vineland area, showing coal stove brooders which are used almost universally.

Fig. 2. Laying houses of one of the pioneer poultrymen in the Vineland area.

Fig. 1. Common arrangement of a long laying house located in the center of a peach orchard.

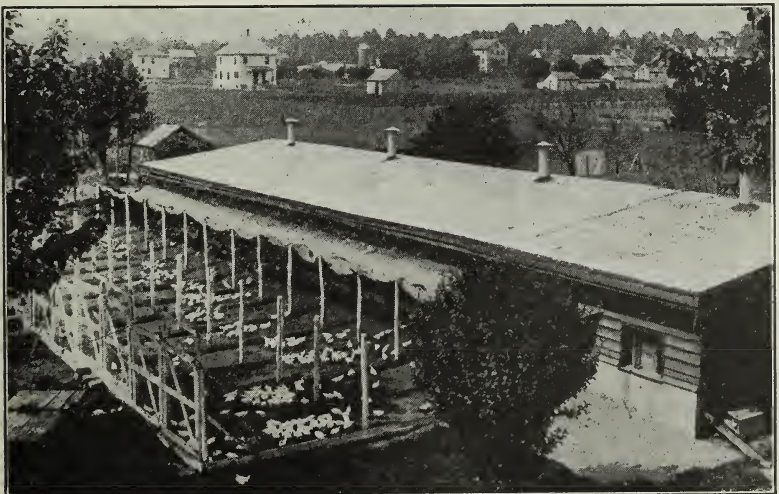

Fig. 2. Laying houses in the Vineland area, showing the range.

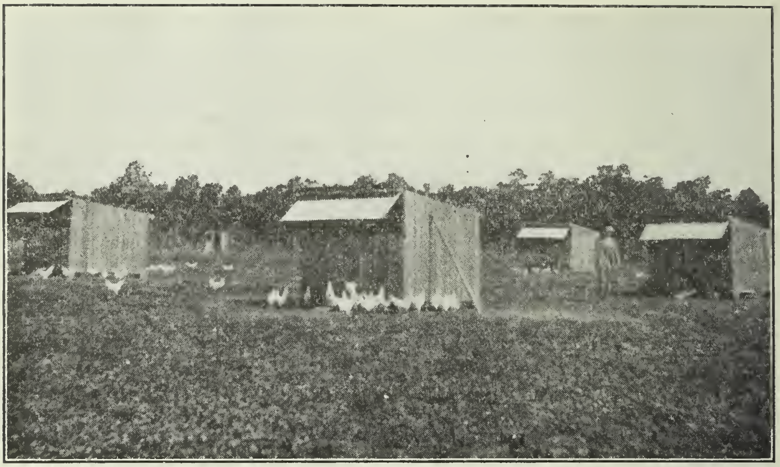

Fig. 1. Range houses in the Vineland area.

Fig. 2. A method commonly used in marketing in the Vineland area. The eggs are taken to the trolley express in wheelbarrows.

New Jersey

Agricultural Experiment Stations

BULLETIN 330

Main Building at the New Jersey Agricultural Experiment Station

REPORT OF THE DIRECTOR FOR 1918

New Brunswick, N. J.

NEW JERSEY AGRICULTURAL EXPERIMENT STATIONS*

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CONTENTS

NEW JERSEY

AGRICULTURAL EXPERIMENT STATIONS

BULLETIN 330

AUGUST 15, 1918

REPORT OF THE DIRECTOR FOR 1918

JACOB G. LIPMAN

Competition of war industries has brought about marked changes in the farm practice of the past season. It happens that New Jersey has a large number of these war industries within its borders and many more in adjacent territory. Naturally, the scale of wages in vogue at plants manufacturing war supplies and equipment is very much beyond that formerly, and even at present, prevailing on the farms of the state. Experienced farm help has been attracted by the high wages and has been lost to the farms.

Not only is there a shortage of experienced farm labor, but much of the labor remaining on farms is, on the average, less competent than formerly. An effort has been made to replace the men who have left the farm by boys of school age and by women. This replacement is not in all cases satisfactory. Fortunately, cooperation on the part of the Commissioner of Labor of New Jersey, of the Federal Department of Labor and of the State Agricultural College has served to distribute as well as is practicable the scant supply of farm labor.

Much uncertainty has also prevailed in the supply and distribution of raw materials needed in crop production. The delivery of fertilizers was very slow in the spring and, in a number of instances, farmers were compelled to plant their crops without fertilizer which had failed to arrive in time. Similarly, the deliveries of farm implements, of seed and of insecticides has been uncertain. The price of these commodities also has gone up. Feed for domestic animals has increased in price to such an extent as to hamper seriously the feeding of poultry, swine and dairy animals. The farmers in our state are realizing that it will be necessary to place orders for raw materials used in crop production at a much earlier date than heretofore.

The disturbed condition of the farm labor market and the enhanced prices of farm supplies have brought about, in certain sections, a more or less far-reaching readjustment in the crop practice. In some of the South Jersey counties the acreage of potatoes was

materially reduced and the acreage of tomatoes increased to a corresponding extent. On the whole, there has been an increase in the acreage of corn and of small grains, and a very marked decrease in the acreage of vegetable crops grown under normal conditions. There has been a marked decrease in the number of dairy cattle in the southern part of the state. There has also been a very marked shrinkage in the amount of poultry in the state. It may be noted here that home gardens still continue to be a factor in food production. The total acreage devoted to home gardens in 1918 is probably less than that in 1917. On the other hand, the gardens are evidently receiving much better care and the volume of food produced from these gardens should be fully as great in 1918 as it was in 1917.

It is already apparent that the unusual industrial conditions now prevailing will react on agricultural production in the state. It is safe to assume that there will be an extraordinary demand after the war for desirable farm lands and that many new settlers will come to New Jersey from other states. For this reason, it would be wise to anticipate the utilization of farm lands now partly or entirely neglected and the putting under cultivation of a great deal of land not yet improved for farm purposes. Some stress will have to be laid on the desirability of organizing as fast as may be practicable agricultural courses in our secondary schools, for we shall depend on these courses for the training of a new generation of farmers. It may be suggested, also, that a greater degree of cooperation will be developed among farmers of New Jersey, both in respect to production and marketing.

The Station's Activities

The progress of the war has brought about some readjustments in the organization and conduct of the work of the Experiment Station. A very considerable number of the staff terminated their connection with the institution to enter the military service of the country. A list of former employees of the station now in the service is given elsewhere in this report. In so far as it was possible, vacancies created by enlistments or draft were filled by men above draft age or those placed in the deferred classes on account of dependents. Nevertheless, the increasing scale of salaries, a sequel to the high cost of food and of other commodities, has tended to interfere with the progress of the Station's work.

Among the accessions to the land, buildings and equipment of the station, there are several which are deserving of special mention. Mr. James Neilson—a trustee and tried friend of the College—has placed at the disposal of the College and Experiment Station his farm-land and outbuildings. There is a total area of about 260 acres owned by Mr. Neilson. Of this acreage 150 acres are tillable and in a good state of cultivation. Mr. Neilson, with his usual generosity, is allowing the College the use of his land and outbuildings without charge. The increased acreage which was made available by Mr. Neilson's action made necessary the engaging

of additional men for farm work and the purchase of additional equipment. An effort was made to solve the labor problem by putting in use three tractors owned by the Station. The excessive rainfall during the early part of the season interfered more or less with the fullest use of these tractors. Nevertheless, results thus far obtained indicate that the farm tractor may be made a valuable ally in general farming. In view of the high cost of feeds, as well as of labor involved in the care of livestock, motor-driven farm machinery should prove an acceptable substitute for draft animals.

The completion of the Dairy Barn, so badly needed, has been delayed on account of the inability of the contractor to secure building materials. It is hoped that it will be completed before cold weather comes on. The completion of the barn will permit of a more economical use of the labor employed in our dairy department. It is expected that the new barn will be conducted as a commercial unit of about 45 milking cows, and that the old barn will be used for heifers and calves. A number of bull pens have been completed and enclosures provided for the young stock. All told, there has been very marked progress in the dairy department. The number of pure-bred and registered animals is steadily increasing, and the time is near when all of the livestock in the dairy department will be pure-bred. Three of the prominent breeds, viz.: Holstein, Jersey and Ayrshire, are well represented. The number of Guernseys in the herd is still very limited, but a good beginning with this breed has already been made. It may be noted here that several Milking Shorthorns were purchased last fall and that a few of these animals will be kept for educational purposes. It may also be noted that the flock of sheep acquired by the Station will be enlarged as conditions may permit.

Certain alterations are being made in the Short Course Building to provide for the establishment of a Home Economics Laboratory in which experimental and demonstration work in home economics may be carried on. This laboratory should be a valuable aid to the home economics specialists in the state, for it will give them an opportunity to test out recipes and methods before recommending them for general adoption in the state.

While every effort has been made to economize in the use of labor on the College Farm Grounds, some progress has been made nevertheless as incidental to the work of crop production. The lines of the first quadrangle of the College Farm have been marked by the planting of shade trees and by a limited degree of grading and filling. The approach to the College Farm is to be made more attractive by the paving of Nichol Avenue, now in progress. This work is being done by the Department of Highway Engineering of the state. It is the pleasant duty of the director of the Station to express his feeling of appreciation to the State Highway Department for the helpful cooperation extended to both the College and Station.

The constant demand for additional space on the part of the extension department of the College and Station has made it neces-

sary to utilize a large part of the Farm House for this purpose. The offices of the state leader of boys' and girls' clubs, as well as the office of the home economics specialists, are now located in the Farm House. Notwithstanding the use of most of the Farm House for this purpose, the Agricultural Building is very much crowded and some of the departments of the Station are suffering from lack of adequate office facilities. It is hoped that the request of the College and Station for a Horticultural Building, repeatedly presented to the Appropriations Committee, will be met in the near future. There is also an urgent need for the construction of a machinery building, in which farm tractors and other farm machinery may be stored and in which instruction in farm mechanics may be carried on. It is realized that the growing interest in the use of motor-driven machinery will compel the agricultural institutions of the state to accumulate first-hand information on the construction and costs of operation of such implements and machinery. It is hoped that funds may be available for the construction of a Machinery Building.

Some of the research work of the Station has been curtailed on account of the lack of fuel. Two of the station green houses were not operated last winter in order that the consumption of coal might be reduced to a minimum. It is expected that through the coming fall and winter economy in the use of coal for greenhouse purposes will be even more rigid. In so far as possible, wood fuel will be used at the College Farm as a substitute for coal. In spite of the most drastic economy, however, very considerable quantities of coal will be needed for heating the offices and laboratories. We hope that this coal will be made available.

The rapidly mounting cost of supplies of all sorts is imposing on the station administration the duty of scrutinizing every item of expense in order that the station budget may be kept within the limits of the appropriation. The cost of feeds and of labor is an important item in the station budget and is, for this reason, receiving special consideration.

An effort is being made to increase the production of home-grown feeds. The production of alfalfa and of other forage crops is considerably beyond the actual needs of the livestock, and some hay will probably be sold. If the growing conditions remain at all normal, the production of corn should not only be sufficient for filling the silos, but should also furnish one-third of the corn needed by the dairy, poultry and animal husbandry departments of the station. A very considerable quantity of oats and peas will also be made available for furnishing part of the concentrates needed in the dairy and animal husbandry departments.

The Experiment Station has enjoyed within the period covered by this report the cooperation of the United States Department of Agriculture, and of the State Departments of Conservation and Development, Education, Labor and Agriculture. The station has also enjoyed the cooperation of the State Agricultural College and State University of New Jersey. Experimental work carried on in cooperation with the United States Department of Agriculture

has included studies of plant diseases affecting tomatoes, the feeding of garbage to swine and the fertilizer requirements of soils especially adapted to the growing of cranberries and blueberries. The Department of Conservation and Development has cooperated, as formerly, with the Experiment Station in the conduct of soil surveys of the state. The State Department of Agriculture has continued its cooperation in certain control work on insects and plant diseases, the organization of farmers' institutes and the carrying on of educational work relating to crops and animals.

The enactment of the so-called Smith-Hughes Bill has provided for cooperative work between the State Department of Education and the State University of New Jersey. Indirectly, this cooperative work affects the activities of the Experiment Station. The organization of agricultural courses in the secondary schools of the state, as a result of this cooperation, will bring to the Experiment Station a certain degree of responsibility in the supplying of technical information on crop production. The Experiment Station has enjoyed in many ways cooperation with the State University in the conduct of demonstration and experimental work. This cooperation allows the most economical use of buildings and equipment, and accrues to the advantage of both institutions.

A summary of the activities of the several departments of the station, as submitted by these departments, is herewith given.

CHEMISTRY

The previous annual reports contain the results of the inspections of feeding stuffs, fertilizers, agricultural limes and insecticides, but since this report is for only eight months, it is impossible to report in detail the results of all of the inspections. The inspection of commercial feeding stuffs is the only inspection that has been completed since the last report, and the results obtained are noted. Brief statements also are made in regard to the other inspections in order that a record may be made of the conditions at the time of rendering the report.

Inspection of Commercial Feeding Stuffs

The manuscript for the bulletin containing the results of the inspection has been prepared and is in the hands of the printer.

During the year, 469 manufacturers and jobbers registered 2553 brands of feeding stuffs which they would offer for sale in this state. The inspectors found 39 brands that were being sold before registration was made. This is an improvement over the preceding year, the local manufacturers being largely responsible for these brands.

The total number of samples examined was 977, and 260—or 27.9 per cent—did not substantially satisfy the guarantees given for the minimum content of protein and fat, and the maximum content of fiber. The deficiencies found consisted of the following: protein, 87; fat, 83; and fiber, 151; 207 samples being deficient in one nutrient; 45 deficient in two nutrients and 8 deficient in the three nutrients. These figures, when compared with the previous

inspection, show that there was an improvement in the character of the feeds examined.

The tonnage of feeding stuffs sold as shown in the tabulation amounts to 234,040 tons, which was about 1300 tons less than was sold during the preceding year and about 6000 tons more than was sold in 1915.

Inspection of Commercial Fertilizers

The collection of the samples of fertilizers representing the spring shipments has been made, and the chemical examinations are being made by the entire chemical force, but the work has not progressed sufficiently to permit any statements as to the character and composition of the materials sold.

Registration

The fertilizer registrations received between November 1, 1917, and January 28, 1918, were published in Bulletin 321.

Inspection of Agricultural Lime

The inspection of agricultural lime products is being carried along with the fertilizer work as usual.

Inspection of Insecticides

Samples of insecticides are being collected. The chemical examination will be made and the results published as usual.

HORTICULTURE

The peach experiments in Orchard No. 1 at Vineland have been conducted for a period of ten years, and, since it is now very difficult and almost impossible to secure some forms of plant-food, this portion of the work has been concluded. The orchard, however, has become the oldest one in the district in commercial condition, and it offered a good opportunity to demonstrate the commercial possibilities of an orchard beyond its tenth year. Each alternate row of trees was pruned back severely in the last winter in order to develop a new top, and a vigorous growth resulted. The other rows will be headed back in the same manner either next year or the following year, so that the entire orchard may be kept vigorous and with low heads.

The extensive peach pruning experiments at Vineland have been continued and a full crop is now on the trees. Some detailed studies are being made this year of the rate of growth of the fruits and twigs in each treatment.

A record has been kept for a period of years of the number of borers removed from each tree in the experiments at Vineland, and this work has been maintained. The number of trees infested and the number of borers found were greatly reduced this year, probably as the result of the work of parasites.

A white seedling freestone peach that ripens a few days before Carman is being propagated for distribution.

Several promising carnation seedlings deserve to be propagated for distribution as soon as conditions permit.

ANIMAL HUSBANDRY

Three distinct lines of feeding experiments received attention in the animal husbandry department during the period November 1, 1917, to June 30, 1918.

One of these feeding experiments consisted of a comparative study of self-feeders versus hand-feeding for market pigs that were allowed access also to forage crops. The second trial, a continuation of earlier experimental work, began on June 15, 1917, with 20 pigs; and the third trial began on July 25, 1917, with 30 pigs. All of the animals were under experiment from weaning time until ready to go to market. It is expected that a fourth test will be carried out in the season of 1918 in order to make certain that the results of the last two seasons are properly checked.

Cooperative experiments are being conducted on the feeding of garbage to hogs. The State Hospital, at Trenton, and the United States Department of Agriculture, as well as the Experiment Station, are participating in this work. The experimental work was begun on June 7, 1918, with 60 pigs. It is proposed to continue the experiments until the animals obtain a marketable weight of from 200 to 250 pounds. The 60 animals are divided into six lots of ten pigs each. They are to be fed as follows:

Lot 1. Cooked garbage.
Lot 2. Raw garbage.
Lot 3. Raw garbage finished on a grain ration
Lot 4. Raw garbage with 1 per cent of grain.
Lot 5. Straight grain ration.
Lot 6. Raw garbage with green forage.

Still another experiment deals with alfalfa as a hay and forage crop. The alfalfa crop used in the experiment was seeded on August 14, 1917. The first cutting was made on May 27, 1918, and the animals were turned into the alfalfa pasture on June 10, 1918. An attempt will be made to determine the value of alfalfa in the economical production of pork.

POULTRY HUSBANDRY

The work of the department of poultry husbandry has progressed very satisfactorily during the past eight months in spite of the serious handicaps occasioned by war conditions. The change in the date of issuing the annual report makes it impossible to report fully on the details and progress of the various research projects. These will be fully reported upon in the next annual report.

The staff of the department has been subjected to many changes, due to demands for men for service in the army. This has handicapped the work at the Vineland contest very materially.

The extreme shortage of staple feeding stuffs and the inability

to obtain them during certain parts of last winter was a very serious problem, making it necessary to curtail many of the feeding research projects. The experimental feeding work has been centered more largely on war emergency problems in an effort to find efficient concentrates which would meet the needs of poultry rations at a moderate cost. One very valuable factor learned during the last year's work is the possibility of greatly increasing the amount of mash fed to laying hens and growing stock, and greatly reducing the amount of grain fed. Such practice results in a great reduction in the cost of the ration and more efficiency in production and growth.

New Jersey, among the other eastern states, has been hard hit in its poultry industry, because of the great distance over which feed and fuel must be transported, as well as the scarcity and high prices of these commodities. In order to help meet this emergency, the poultry husbandman of the Experiment Station has personally devoted considerable time and energy to meet these problems through cooperative and organization methods. The correspondence of the department has increased during the year, much of which has been of an emergency nature.

Practically all of the breeding work which has been under way for the past few years has been maintained, though somewhat reduced in volume. The work at the Vineland contest has progressed in an exceptionally gratifying manner. The two-year-old hens during the current year have succeeded in laying a production nearly equal to their pullet performance. Excellent results have been attained in the hatching and rearing of the young stock from the contest birds, and a very promising year of the contest is anticipated. The contest has brought out many valuable research results, from a breeding as well as from a feeding standpoint.

The policy of the poultry department in meeting the war emergency is two-fold: first, to keep thoroughly informed of existing conditions in the state by studying through every possible means the condition of every changing factor affecting the industry and to determine the reaction of such conditions upon production; and, second, to attempt to stimulate in every possible way a greater efficiency in poultry production and to strive in so far as is consistent with cost and revenue factors, to maintain production With the aim of meeting this program, definite suggestions and teachings have been promulgated and given wide publicity through personal contact with organizations, through demonstration projects, and through individual visits, as well as through the agricultural and poultry press and through our regular "Hints to Poultrymen."

The aims and purposes in administering the forces of the poultry department are and will be to help win the war by uniting the poultry interests of the state; by fostering the industry through proper counsel and advice, and through the closest attention to these efforts to support the nation in the production of an adequate supply of poultry and eggs.

DAIRY HUSBANDRY

The following five principal lines of endeavor have been pursued by the department of dairy husbandry during the eight months ending June 30, 1918.

Experimental

The experimental work has consisted principally of the long-time experiment on the conformation of dairy heifers as indicating their future production. This experiment has been running for two years. A new experiment, The Milking Machine and Its Relation to Sanitary Milk Production, has been started during the past year.

Extension Work

The dairy extension work has been exceptionally heavy during the past year. Advice and assistance to the dairymen of the state have been given through cooperative dairy projects, correspondence, personal visits and institutes.

One new dairy record association has been formed, making in all nine active dairy record associations.

The formation of the State Dairymen's Association has been completed.

Advanced Registry Work

There has been a slight increase in the number of cows on advanced registry. From this it is evident that the breeders, even under the adverse conditions of feed and labor, have confidence in the future of the dairy cattle industry.

Glassware and Testers' License Law

The supervision of the creameries and milk plants in the state with reference to their testing of milk and cream where milk and cream are purchased on the butterfat basis has been carried on in a similar manner as in the previous year. A total of 1,985 pieces of glassware were tested with an average proportion of inaccuracy of 3.8 per cent. This shows that the law is having its effect in bringing a better grade of glassware into the state.

The Dairy Herd and Equipment

The dairy herd has seen a substantial increase to June 30, 1918, totalling 102 animals. The total at the end of the last fiscal year was 74, showing an increase of 28 animals.

A new addition to the barn has been almost completed. This work has been very much hindered because of inability to get materials, but undoubtedly the barn will be ready for the stabling of cattle by cold weather.

SEED CONTROL

The unusual conditions of the country's seed supply, the demand for crop production and a growing appreciation of the importance of good seeds in relation thereto, have had a marked effect

on the extent of service demanded from the seed laboratory. Fortunately, conditions enabled this department to meet the demand and much has apparently been gained in establishing the necessity of maintaining the seed laboratory.

In particular, it was possible to perform a very beneficial service to the corn growers of the state, who faced the 1918 season with a very uncertain supply of seed. Testing many samples for farmers, issuing instructions for home testing and emphasizing the need of most careful discrimination in selecting seed corn saved many thousands of dollars to the state.

The official inspection of dealers' stock has been seriously limited by lack of funds. This is a most important phase of the work and, if neglected, the object of the law will be altogether nullified. For this work there is most urgent need of a man who can be in the field all the time, if necessary, maintaining contact with dealers throughout the state and sampling dealers' stock freely. In this way only can the seed laboratory approach the desired condition of assuring accuracy of label statements to purchasers. The laboratory is organized and equipped, and to do its utmost there must be sufficient appropriation to extend the work as indicated.

AGRONOMY

The agronomy department has continued the work of the preceding year, some of which has been finished and has been placed in manuscript form for publication. The study of the source of alfalfa seed, the time of seeding alfalfa and the methods of raising alfalfa, together with that of sweet clover, is much the same as in the preceding year. Because of lack of assistance and shortage of funds, the work on varieties of grains had to be discontinued at this time.

Farm management on poultry farms and the cost of egg production was studied during the past year in cooperation with the poultry department. The study has brought to light some very pertinent information on this important industry which has suffered so severely because of war conditions.

The study of the cost of milk production and the organization of dairy farms was also made and completed during the past year, so that the Station was enabled to produce real evidence when investigations were made on the cost of milk production for the New York and Philadelphia markets. This evidence was presented to the New York Dairy Committee, appointed to investigate the cost of milk production, the Federal Milk Commission for the New York market, as well as the Commission of the City of New York alone, which investigated the cost of milk production.

Much time has been given to emergency work concerning such problems as affect the farm most vitally.

Farm labor has received considerable attention through this department. Much time has been devoted to the distribution and use of good alfalfa seed, while the improvement of corn through out the state has been given considerable attention through the ex-

tension division and through the State Corn Show, which was under the direction of the agronomy department.

The marketing and grading of alfalfa also has been taken up by the department, so that we can now assure the farmers who wish to grow this crop that there is a good and definite market waiting for their product.

Agricultural Extension

Emergency war work has interfered seriously with the regular educational work of specialists and county farm demonstrators. Only one thing really counts today, and that is the winning of the war. The members of our staff have neglected their educational projects only so far as immediate necessities required. The policy has been to maintain the leading ones, but the urgent calls of the national government for service have not been neglected.

The reports of leaders in county farm demonstration, home demonstration, boys' and girls' club work and the reports of the specialists are submitted with a considerable degree of pride. The thorough organization of county farm demonstration is due largely to Mr. John H. Hankinson, who resigned from the state leadership May 1, 1918. Our thanks are due to Prof. Frank App, head of the department of agronomy in the Station and College, who most kindly became acting state leader and served most efficiently until the close of the fiscal year.

The home demonstration work has been well organized by its state leader, and is especially serviceable under present war conditions.

The state club work has been put upon an especially satisfactory basis by its state leader.

Our farm demonstration work, manned by a staff of earnest, efficient men, owes much to the specialists connected with the central office.

Probably the outstanding fact in the eight months' experience is the development of community interest and team work in our various counties, with the assistance of capable farm demonstrators, that is helping in a practical way to win the war. The extension staff has worked as a unit in a most gratifying degree.

Soil Chemistry and Bacteriology

The report for this year is short, since the date for the ending of the fiscal year has been changed from October 31 to June 30.

Field Plots

This work has been continued as outlined in previous reports and bulletins. This year being the first of the third 5-year period, the majority of the plots are in corn. The land was plowed and prepared early and the corn planted about the middle of May. With the exception of considerable cool weather, the season has been favorable and the corn is now in excellent condition.

The scarcity of potash, together with the fact that these plots

have had generous applications of this material for the past ten years, led to the decision to omit the potash from most of the plots this year. It is believed that such omission will not in any way interfere with these experiments. Other fertilizers were applied in accordance with the plans.

The work with different varieties of soybeans on lime and unlimed plots is being continued. At this writing all varieties on limed plots are much superior, both as to size and color, to corresponding varieties on unlimed plots. Samples of soil have been collected from most of the plots for future analysis.

Cylinder Experiments

The experiments on the availability of nitrogen in different nitrogenous materials and the accumulation and utilization of nitrogen by means of leguminous crops are being continued.

This season begins the fifth 5-year period for the loam soil cylinders where nitrogen availability studies are being carried on. These cylinders are now in corn and this is in excellent condition, except where the fertilizer treatment has been adverse. A partial summary of the results from these cylinders for the first twenty years has been published.

Potash Availability

The work on the availability of potash in greensand marl is being continued by means of pot experiments. The plan calls for the growing of certain crops such as soybeans and buckwheat which may be able to utilize slowly-available potash, these crops to be used in turn as manure crops to supply potash for such crops as require a more available supply of potash.

Soil Fungi and Bacteria

On account of the withdrawal of Messrs. J. R. Neller and R. E. Curtis for other service, little work was done on these projects during the period covered by this report. After the first of July the work will be carried on by Dr. S. A. Waksman, who was formerly connected with this department.

Potato Fertilizer Experiment

The cooperative fertilizer experiment with potatoes at Elmer has been continued. The work this year is practically a duplication of last year's work. The plan allows for a study of the residual effect of the marl which was used last year. There are very strong indications that there is a close relationship between the fertilizers used and the early dying of the tops. It is hoped that the problem can be further studied next year.

BOTANY

The projects carried on in this department may be briefly described as follows:

Inheritance of Hybrid Characters. Subjects in hand are (1)

the bean hybrid between "Scarlet Runner" and "Refugee Wax"; and (2) the egg-plant hybrid, a union of "Dwarf Purple" and "Scarlet Chinese." Two hundred plants of the former and fifty of the latter are now growing for study and comparison.

Inheritance of Prolificness. Selections of prolific and non-prolific plants are made according to yield. No definite results have been obtained as yet.

The Fixation of New Types. Desirable strains often result in breeding work.

Size of Seed as Related to Position in the Pod. The plants of this experiment are beans, peas, peanuts, soybeans and grains.

Depth of Planting as Related to Viability, Vigor and Yield. Beans, corn and soybeans come under this heading. The planting depths for beans are 1, 2 and 3 inches; for corn, 1, 2, 3, 5 and 7 inches.

Plant Physiology. During the year particular attention has been given to the following lines of work: A study (1) of the salt requirements of plants at different stages of their development, in sand and in solution cultures, (2) of the relation of moisture content of various types of soil and sand to the proportions of the fertilizer constituents as these affect the growth of plants, and (3) of the influence of moisture content of the substrata upon the toxicity of certain inorganic salts toward plants.

ENTOMOLOGY

In this period of eight months the entomologist and his assistants have handled 4000 letters, and inquiries concerning 82 species of insects have been received and answered.

For the first time it has been determined that summer-strength commercial lime-sulfur (1 gallon to 40 gallons of water) may be used to hold the pear psylla in check.

Satisfactory control of the plum curculio on apple has been obtained through maintaining a coating of summer-strength commercial lime-sulfur (1 gallon to 40 gallons of water) and arsenate of lead (2 pounds to 50 gallons) on fruit and foliage from the fall of blossoms until a period of three weeks has passed. To maintain this coating the ordinary spraying schedule must be modified by substituting for the spray recommended ten days after the blossoms drop a treatment one week or less after the blossoms fall and another treatment ten days later.

It has been determined that the sprinkling sewage filter fly, a small insect of considerable economic importance and always found in connection with sprinkling sewage filters, may be destroyed by submerging the filter for a period of 24 hours with the ordinary sewage.

A cooperative study of the biology of a sprinkling sewage filter has been organized and money provided therefor. The cooperators are the New Jersey State Board of Health, the New Jersey Agricultural Experiment Station and the Joint Sewer Commission of the City of Plainfield and the boroughs of North Plainfield and Dunellen.

An organization has been created and is now carrying forward, under a plan made in conference by the growers and the director and entomologist of the Station, investigations of the plant-food problems, soil acidity problems, soil moisture problems and insect problems of cranberry culture.

It has been determined that 98 to 100 per cent of aphid eggs, which are well coated with a mixture composed of commercial lime-sulfur, 1 gallon in eight or nine gallons of water to which 40 per cent nicotine has been added at the rate of 1 to 500, are destroyed provided the application is made just before the leaves project from the opening apple flower buds like tiny squirrel ears.

It has been determined that 1½ to 2 per cent of crude carbolic acid to which fish-oil soap is added at the rate of 1 pound to 6 gallons of water gives considerable promise as an agent for destroying apple aphis eggs when applied at the time above mentioned. It has also been shown that when 40 per cent nicotine (1 to 500) is substituted for the crude carbolic acid the same result follows.

It has been shown that card protectors placed on peach trees in late June and kept thoroughly sealed throughout the season to October first prevents all or practically all of the trees from being infested with worms arising from eggs laid during that season.

A contract for cutting 275,862 linear feet of ditching in the salt marshes of Ocean and Cape May counties has been let to the United States Drainage and Irrigation Company for the sum of $9600.

Hudson, Bergen, Passaic, Morris, Essex, Union, Middlesex, Monmouth, Ocean, Atlantic and Cape May counties are working on the control of mosquitoes during the present season. Hudson, Bergen, Essex, Union and Atlantic counties are attacking the problem of controlling all species that breed within their limits. Passaic County is attacking the problem of controlling all species that breed in the southern half of the county. Middlesex, Monmouth, Ocean and Cape May counties are devoting practically their entire attention to the salt-marsh mosquito problem. Morris County is making a survey of the mosquito-breeding places within its limits with the view to the formulation of plans for attacking the problem as a whole.

Plans for mosquito control at the Raritan Ordnance Depot at Bonhamtown, N. J.; at the New York Shipbuilding Corporation, Camden; at the New Jersey and Pennsylvania Shipbuilding Companies in Gloucester; at the Atlantic Loading Company in Ellwood, and the Bethlehem Steel Testing Plant at Mays Landing, have been prepared and submitted to the organizations in question. The work is now going forward at the Raritan Ordnance Depot and at the Camden and Gloucester Shipbuilding plants.

Plans for mosquito elimination in the Frank Creek section of the Kearney marshes west of Frank Creek have been prepared and submitted to the Hudson County Mosquito Extermination Commission.

Plans for the installation of a 3-flume tide-gate at the mouth

of Saw Mill Creek are being prepared and the money involved has been raised.

At the request of the chief of sanitation and health of the Emergency Fleet Corporation, plans for the control of mosquitoes at the International Shipbuilding Corporation plant, located on Hog Island, for the Westinghouse electric plant, located at Essington, and various housing propositions connected therewith, and plans for the control of mosquitoes at the three shipbuilding yards in Wilmington, North Carolina, have been prepared. Work is now going forward at these points.

An investigation has been made and plans for mosquito control for the area beginning at Penns Grove and extending northward to Camden and Gloucester have been prepared.

All told, these plans are made to provide protection for approximately 177,000 people at a cost of a little less than half a million dollars.

Projects involving the expenditure of $263,000 are now going forward, and the employees and persons living adjacent to the International Shipbuilding Corporation, the Westinghouse Electric Company, the Wilmington Shipyards, the New York Shipbuilding Corporation, the New Jersey Shipbuilding Company, the Pennsylvania Shipbuilding Company and a Bag Loading Plant below Gloucester either are already or soon will be afforded a reasonable degree of protection from the mosquito pest.

Plant Pathology

Mr. C. M. Haenseler, Mr. R. F. Poole, Mr. F. P. Schlatter and Dr. W. H. Martin are in the United States Military Service. Mr. C. A. Schwarze resigned as assistant nursery inspector June 1, 1918. Dr. L. M. Massey, of the United States Department of Agriculture, has been assigned to New Jersey for extension work in plant pathology and is stationed at New Brunswick. Mr. Erdman West, of Pennsylvania State College, has been employed as assistant nursery inspector.

The research work has been greatly reduced because of war conditions, but studies are being continued on tomatoes and potatoes and on other diseases wherever possible.

It is very important that special studies be made on seed-bed diseases and upon the diseases of truck crops, and also upon the influence of disease on perishable products in shipment.

There should be another worker in the department giving the greater part of his time to the study of resistant strains of plants. There should be another worker devoting practically all of his time to the study of the diseases of potatoes, especially those that are transmitted in the seed. Studies should also be continued on celery and other truck crops.

It is very important that something should be done to put the herbarium in condition for work to the best advantage.

The plant disease survey of the United States Bureau of Plant Industry, carried on in cooperation with the various states, is prov-

ing very helpful and there should be a more thorough survey of the diseases of New Jersey.

PUBLICATIONS

The office of the editor has been concerned during the fiscal year with the following main lines of activity: (1) the revision of the mailing list, (2) the editing and publishing of the regular Experiment Station and extension publications, (3) special publicatons, (4) special publicity work and (5) plans for the improvement and expansion of the publications and publicity work.

The revision of the mailing list has involved much time and effort. Several thousand "dead" addresses have been dropped from the old list; names of persons on the old list who still desire our publications have been retained and new addresses have been added through the use of the mailing lists of the State Department of Agriculture, the county boards of agriculture and the poultry associations. The work of revision is still in progress at this writing. The list has been carefully classified, and through the use of a new addressograph machine equipped with a selective device, which was installed during the year, a great saving is being accomplished in our publications as well as better service to persons receiving them. It is planned to increase the efficiency of the mailing service still further by the use of a graphotype machine, making it possible for us to make our address plates in our own office, as soon as funds will permit.

The following regular publications have been issued during the year, and have been or will soon be sent to the mailing list:

Bulletins

No.
315 Analyses of Materials Sold as Insecticides and Fungicides for 1917.
316 The Influence of Lime upon the Yield of Dry Matter and Nitrogen Content of Alfalfa.
317 Report of the Director for the Year Ending October 3, 1917.
318 Analyses of Commercial Fertilizers and Ground Bone: Analyses of Agricultural Lime.
319 A Study of Physiological Balance for Buckwheat Grown in Three-Salt Solutions.
320 Farm Profits and Factors Influencing Farm Profits on 460 Dairy Farms in Sussex County, N. J.
321 Fertilizer Registrations for 1918.
322 Results of Seed Inspection, 1917.
323 The Value of Nitrate of Soda in Crop Production.
324 The Strawberry Weevil.
325 Poultry Buildings: Laying and Breeding Houses.
327 Commercial Feeding Stuffs and Registrations for 1918.
328 Some Important Orchard Plant Lice.

Circulars

No.
88 Common Diseases of Berries.
89 Common Diseases of Garden Vegetables and Truck Crops.
90 The Feeding and Management of Swine.
91 The Bean Weevils.
92 The Angoumois Grain Moth.

93 Spray Calendar for Apples and Quinces.
94 Spray Calendar for the Peach.
95 Seed and Soil Treatment for the Control of Potato Scab.
96 Leaf Blight of the Tomato.
97 Common Diseases of Ornamental Plants.
76 Spray Calendar for Pears. (Reprint.)
77 Spray Calendar for Sweet Cherry. (Reprint.)
78 Spray Calendar for Plum. (Reprint.)

Reports

1917. Thirty-Eighth Annual Report of the New Jersey State Agricultural Experiment Station, and Thirtieth Annual Report of the New Jersey Agricultural College Experiment Station.

Hints to Poultrymen (monthly), vol. 6, no. 2-9.

Publications of the Division of Extension

Extension Bulletin

Vol. 1, No. 14. Proper Care and Use of Farm Manure.
No. 15. Home Canning and Curing of Meats.
No. 16. Boys' and Girls' Club Work in New Jersey.
No. 17. Breads: Good Breads that will save Wheat.
No. 18. Farm Labor.

The Farm Demonstration Exchange (monthly), Vol. IV, No. 1-5.
The Weekly News Letter, vol. 5, no. 1-35.
Poster Bulletin 1, "Prevent Waste of Farm Manure".

Also, the editor has assisted in the preparation of the monthly news letters of the county offices of farm demonstration.

Beginning with January, 1918, provision was made for the editor's office to handle the editorship of the "Voorhees Farmer", a monthly agricultural journal established by the E. B. Voorhees Agricultural Society in 1917. The members of the Experiment Station staff have given valuable cooperation in conducting this journal. The station editor has continued his work with "Soil Science," which is published by the Waverly Press, of Baltimore, Md. This journal has furnished a useful medium for the publication of many research articles prepared at the Experiment Station, and has thus effected a saving of station funds which would have otherwise been used in printing the papers as station publications. The "Experiment Station News" has been continued as a medium for local Experiment Station publicity of interest to the staff members, and for the local newspapers.

A limited amount of special publicity work has been done for the Experiment Station. Special articles have been written for the daily papers of New Jersey, and distributed through one of the news agencies of the state.

The editor has been greatly assisted by the cooperation of the Publicity Committee of the Experiment Station Council. The committee made a study of the present publicity system and its needs, and outlined a policy which was adopted by the Experiment Station Council. Several of the recommendations have already been put into effect, and it is planned to follow out the whole program as soon as conditions permit. A summary of the recommendations follows: (1) Brevity, clearness of expression and emphasis

of the practical aspects of recommendations in popular bulletins and circulars, (2) the more extensive use of suitable illustrations in popular publications, (3) the publication of condensed, one-page extension circulars or cards, (4) the enlargement of the mailing list, (5) the publication of a well-illustrated circular describing in a popular way, the work of the Experiment Station, (6) the use of a slip bearing summarized information concerning the Experiment Station, to be enclosed with correspondence, (7) a publicity service to the newspapers of the state and other agencies, consisting of special multigraphed letters, (8) the establishment of a clipping service. (9) the preparation of cardboard posters telling how the Experiment Station may be of assistance to the farmer, to be distributed about the state, (10) the installation of a multigraph machine, and (11) provision in the budget for more finances to support publicity work.

This report indicates the needs of the editor's office and shows the lines of work along which effort is being made. Throughout the year special attention has been given to the emergency conditions arising from the war, and a large proportion of the work has been directly concerned with problems of increasing food production as related to war needs.

TECHNICAL PAPERS

Experiments with Sulfur-Phosphate Composts Conducted under Field Conditions. J. G. Lipman and H. C. McLean. *Soil Science,* vol. 5, p. 243 (1918).

Twenty Years' Work on the Availability of Nitrogen in Nitrate of Soda, Ammonium Sulfate, Dried Blood and Farm Manures. J. G. Lipman and A. W. Blair. *Soil Science,* vol. 5, p. 291 (1918).

Abortiveness as Related to Position in the Legume. Byron D. Halsted. *Proceedings of the Thirty-sixth Annual Meeting, Society for the Promotion of Agricultural Science,* November, 1917.

Color in Vegetable Fruits. Byron D. Halsted. *Journal of Heredity,* vol. 9, p. 18, January, 1918.

Reciprocal Breeding in Tomatoes. Byron D. Halsted. *Journal of Herdity,* vol. 9, p. 169, April, 1918.

Toxicity of Monobasic Phosphates Towards Soybeans Grown in Soil and Solution Cultures. J. W. Shive. *Soil Science,* vol. 5, no. 2, p. 87-122 (1918).

A Comparison of Salt Requirements for Young and for Mature Buckwheat plants in Water Cultures and Sand Cultures. J. W. Shive and W. H. Martin. *American Journal of Botany,* vol. 5, no. 4, p. 186-191 (1918).

Effects of Ammonium Sulfate in Nutrient Solutions on the Growth of Soybeans in Sand Cultures. M. I. Wolkoff. *Soil Science,* vol. 5, no. 2, p. 123-150 (1918).

The Oxidation of Sulfur by Microorganisms in its Relation to the Availability of Phosphates. H. C. McLean. *Soil Science,* vol. 4, no. 4, p. 337 (1917).

Studies on the Correlation between the Production of Carbon Dioxide and the Accumulation of Ammonia by Soil. J. R. Neller. *Soil Science,* vol. 5, no. 3, p. 225 (1918).

Some Availability Studies with Ammonium Phosphate and its Chemical-Biological Effects upon the Soil. F. E. Allison. *Soil Science,* vol. 5, no. 1, p. 1 (1918).

The Mosquito Question: Migration as a Factor in Control. Thomas J. Headlee. *Scientific American Supplement,* vol. 85, no. 2205, p. 214, April 6, 1918.

Effective Methods of Fly Control: A Review of the Factors that Underlie the Problem. T. J. Headlee. *Scientific American Supplement,* vol. 85, no. 2201, p. 150, March 9, 1918.

The Problem of Mosquito Control. T. J. Headlee, *Proceedings of the Entomological Society of Ontario,* January, 1918.

Studies on the Morphology and Susceptibility of the Eggs of *Aphis avenæ* Fab., *Aphis pomi* DeGeer and *Aphis sorbi* Kalt. Alvah Peterson. *Journal of Economic Entomology,* vol. 10, p. 556-560 (1917).

Some Experiments on the Adults and Eggs of the Peach Tree Borer, *Sanninoidea exitiosa* Say and Other Notes. Alvah Peterson. *Journal of Economic Entomology,* vol. 11, p. 46-55 (1918).

The Rectal Tracheæ and Rectal Respiration in *Mecistogaster Modestus* (*Odonata*). Mitchel Carroll. *Proceedings of the Philadelphia Academy of Natural Sciences for 1918.*

POPULAR PAPERS

Our Fertility Resources as Bearing on the Present Emergency. J. G. Lipman. *N. J. State Department of Agriculture* Bulletin 11, January, 1918.

Soil Bacteria as a Factor in Soil Fertility. J. G. Lipman, *Philadelphia Society for Promoting Agriculture, Bethayres, Pa.,* March, 1918.

Articles on Organic Matter, Lime and Fertilizers. Alva Agee. *The Farmer's Own Encyclopedia.*

How Shall New Jersey Peaches be Graded and Marked? M. A. Blake. *Proceedings of the New Jersey State Horticultural Society,* 1917.

The Fruit Exhibit at the Trenton Fair. M. A. Blake. *Voorhees Farmer,* November, 1917.

Observations upon Summer Pruning of the Apple and Peach. M. A. Blake. *Proceedings of American Society for Horticulural Science,* 1917.

Important Points in Apple Spraying. M. A. Blake. *Voorhees Farmer,* May, 1918.

Suggestions to Fruit Growers. M. A. Blake. *Voorhees Farmer,* March, 1918.

Fine Apple Crop in Demonstration Orchards. M. A. Blake. *Voorhees* Farmer, July, 1918.

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Paper Pots and Dirt Bands. L. G. Schermerhorn. *Rural New Yorker,* March 2, 1918.

Notes on New Varieties of Strawberries. A. J. Farley. *Voorhees Farmer,* June, 1918.

In the Interests of Fair Play. John P. Helyar. *Seed World,* July, 1918.

Make it Buckwheat. Frank App. *Voorhees Farmer,* May, 1918.

Alfalfa in New Jersey Gets Big Boost. Frank App. *Voorhees Farmer,* February, 1918.

Corn Show a Big Success. Frank App. *Voorhees Farmer,* February, 1918.

What About Next Year's Farm Labor? Frank App. *Voorhees Farmer,* January, 1918.

New Jersey's 1918 Corn Crop. Frank App. *Voorhees Farmer,* April, 1918.

Caring for the Crops. Frank App. *Voorhees Farmer,* June, 1918.

Alfalfa Association Making Progress. Frank App. *Voorhees Farmer,* March, 1918.

Home Preservation of Eggs. R. R. Hannas. *Rural New Yorker,* April 6, 1918.

Quality in Market Eggs. R. R. Hannas. *Country Gentlemen,* April 27, 1918.

Care of Growing Chicks. R. R. Hannas. *Pennsylavnia Farmer,* June 1, 1918.

The Relationship of the Manufacturer to the State Official. C. S. Cathcart. *Feeding Stuffs Trade Paper,* July, 1918.

Fertilizers Essential for Big Crops. A. W. Blair. *Hoard's Dairyman,* February 15, 1918.

An Experiment in Pig Feeding. J. M. Hunter. *Rural New Yorker,* July, 1918.

Feeding Soft Corn to Hogs. J. M. Hunter. *Voorhees Farmer,* November, 1917.

Hogs and The World War. J. M. Hunter. *Voorhees Farmer,* December, 1917.

The Winter Care of Farm Horses. J. M. Hunter. *Voorhees Farmer,* January, 1918.

Replies to What the Farmers are Asking. J. M. Hunter. *Voorhees Farmer,* February, 1918.

Replies to What the Farmers are Asking. J. M. Hunter. *Voorhees Farmer,* March, 1918.

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Use Wheat Substitutes for Pigs. J. M. Hunter. *Voorhees Farmer,* July, 1918.

Dairying in Winter. J. W. Bartlett. *Pennsylvania Farmer,* January, 1918.

Calf Club Work in New Jersey. J. W. Bartlett. *Kimball's Dairy Farmer,* July 15, 1918.

The New Jersey State Dairymen's Association. J. W. Bartlett. *Hoard's Dairyman,* June 12, 1918.

Control of Orchard Plant Lice. T. J. Headlee. *Pennsylvania Farmer,* March, 1918.

Staff Changes

A list of changes in the station staff during the past eight months is given herewith:

Appointments

C. S. Lamson	Research Assistant
Isabel V. Delaney	Telephone Operator
William Whynman	Poultry Assistant
Cyrus Witmer	Assistant, Soils Department
A. Sydney Carroll	Teamster
Ernest O. Winkler	Helper
Hazel H. Moran	Assistant Librarian
Frank G. Helyar	Associate in Station Administrat'n
Maurice Fincken	Orchard Foreman
Nils B. Swenson	Helper
Helen L. Goodwin	Statistician
Sarah E. Van Middlesworth	Office Assistant
M. E. Stone	Helper
C. S. Clarkson	Assistant Chemist
W. B. J. Reitze	Contest Foreman
Noyes S. Purrington	Fertilizer Sampler
Mitchell Carroll	First Assistant in Entomology
Cyrus H. Harrison	Helper
Clifford Strohmeyer	Helper
William J. Stoneback	Assistant Chemist
Russell H. Sears	Orchard Assistant
Irving L. Owen	Associate Agronomist & Farm Mgr.
Fred Boorman	Helper
Robert H. Cole	Assistant Chemist
Louis Schwartz	Assistant Chemist
Fred C. Corwin	Helper
F. A. Hall	Helper
P. C. Cameron	Temporary Assistant Biologist
E. B. Bleeker	Field Assistant
Fred Freund	Helper
Charles M. Mulhollan	Helper

The following also were employed in a temporary capacity: George W. Woods, James McPherson, Felix Ramsey, Zelik Schutzbank, Frederick C. Bruer, Richard Goines, Harold Barbour, Isaac Reis, Cornelius A. Perry, Svenn A. Rusch, Harry M. Allen, Frank Welchman, Louis Zimmerman, Walter R. Robbers, Dudley Cobb, Charles H. Cane, Benjamin Masurovsky, Eugene W. Bates and Joseph Fox.

Resignations

Joseph R. Neller	Research Assistant
Robert F. Poole	Research Assistant
Charles S. Lamson	Research Assistant
William H. Martin	Research Assistant
Russell E. Long	Office Assistant
Edward W. Harvey	Research Assistant
Hubert F. Brennan	Night Watchman
Merrill G. Clayton	Helper
W. Raymond Stone	Orchard Foreman
D. James Kay	Assistant Chemist
Paul S. Race	Helper
James G. Rugh	Contest Foreman
Allen G. Waller	Assistant Extension Specialist in Agronomy
Marie A. Klein	Statistician
Joseph Schmidt	Helper
George T. Reid	County Supt. of Farm Demonstration for Burlington County.
C. S. Clarkson	Assistant Chemist
R. L. Scharring-Hausen	Field Assistant
Joseph Kovanda	Helper
William B. J. Reitze	Contest Foreman
Melvin Cosh	Helper
John H. Hankinson	State Leader of Farm Demonstration.
Robert Poultney	Assistant Extension Specialist in Dairy Husbandry.
Charles S. Van Nuis	Associate Agronomist and Farm Manager.
Willard C. Thompson	Assistant Poultry Husbandman.
William Whynman	Poultry Assistant.

The following members of the staff have resigned to enter the military service of the country: Louis K. Wilkins, Herman J. Levine, David Schmidt, Orville C. Schultz, Conrad M. Haenseler, Thurlow Nelson, John Monteith, Jr., Lawrence G. Gillam, Howard F. Huber, Julian F. Miller, Fidel P. Schlatter, Richard Goines, William H. McCallum, George M. Dunn, Carl Egerton, J. Manderson Evans, Robert F. Poole, Joseph R. Neller, William H. Martin, Russell E. Long, Allen G. Waller, Robert P. Marsh, Charles S. Lamson, Willard C. Thompson, William Whynman, George W. Martin, David A. Coleman, Carl R. Fellers, Joseph Schmidt, W. J. Stoneback, A. P. Muller, Robert E. Welsh, Robert I. Clark, Harry M. Allen, J. H. Dumm, Leslie Morrow, L. W. Hill, Robert Poultney, A. H. Sanford, William H. Nulton and Albert Smith.

ANALYSES OF COMMERCIAL FERTILIZERS,
FERTILIZER SUPPLIES AND HOME MIXTURES

NEW JERSEY

AGRICULTURAL

Experiment Stations

BULLETIN 331

New Brunswick, N. J.

NEW JERSEY AGRICULTURAL EXPERIMENT STATIONS*

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Cyrus Witmer, Field and Laboratory Assistant.

*Staff list revised to February 1, 1919.

NEW JERSEY AGRICULTURAL EXPERIMENT STATION
DEPARTMENT OF AGRICULTURAL EXTENSION
ORGANIZED 1912

AND

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CONTENTS

NEW JERSEY

AGRICULTURAL EXPERIMENT STATIONS

BULLETIN 331

OCTOBER 10, 1918

ANALYSES OF COMMERCIAL FERTILIZERS, FERTILIZER SUPPLIES AND HOME MIXTURES

Charles S. Cathcart, *State Chemist**

The fertilizer law of this state requires an inspection of the materials sold as fertilizers, and such an inspection includes the collection of the samples as well as the chemical analyses of the various brands located. The collection of the samples for 1918 has been completed and this bulletin contains the results of the chemical analyses of practically all of the brands collected during the spring months, with the exception of the samples of ground bone and sheep manure.

A collection was made of the shipments of fertilizer intended for fall use and the results of these analyses, as well as the analyses of the brands that were collected in the spring and are not reported at this time, will appear in a later bulletin. This second bulletin will also contain a discussion of the entire inspection.

Tabulated Analyses

The results that are tabulated on the following pages show the composition of 204 brands of fertilizers containing nitrogen, phosphoric acid and potash, 274 brands containing nitrogen and phosphoric acid, 5 home mixtures and 114 samples of fertilizer materials.

In addition to the above the analyses of 17 duplicate samples of commercial fertilizers are tabulated in their proper places. The total number of analyses reported in this bulletin is 614.

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*The chemical analyses were made by Ralph L. Willis, Robert H. Cole, Louis Schwartz and Archie C. Wark.

Examination of Unmixed Fertilizer Materials

The results of the examinations of 114 samples of standard unmixed materials are given in the following pages in tabular form. With a few exceptions, the analyses indicate that the materials were of good quality but that there is a great necessity to study the guarantees as given in order to know the total amount of plant-food that will be obtained in a given weight of the material.

Nitrate of Soda. Twenty-two samples of nitrate of soda were examined and the nitrogen content varied from 14.40 to 15.45, with an average of 15.16 per cent. The samples contained from 87.4 to 93.8, with an average of 92 per cent of nitrate of soda.

One of the samples represented the material purchased from the United States Department of Agriculture and contained 15.45 per cent of nitrogen.

Two samples of 15 per cent nitrate of soda were examined and they contained 12.20 and 12.15 per cent of nitrogen, respectively, the guarantee stated in terms of nitrogen being 12.34 per cent.

Sulphate of Ammonia. Only one sample of this material was received and it contained 19.97 per cent of nitrogen, the guarantee being 20.50 per cent. The nitrogen content was equivalent to 94.2 per cent of sulphate of ammonia.

Dried Blood. Three samples of material sold as dried blood were examined. One of these samples, however, contained an excess of phosphoric acid and a corresponding decrease in its content of nitrogen, which indicates that it was not an unmixed product.

The two samples of dried blood averaged 12.78 per cent of nitrogen and 1.00 per cent of phosphoric acid.

Dried and Ground Fish. Four samples were examined and the nitrogen content varied from 8.24 to 9.12, with an average of 8.75 per cent. The content of total phosphoric acid varied from 1.10 to 8.06, with an average of 4.18 per cent.

Crude Fish. The one sample examined contained 7.60 per cent of nitrogen and 5.72 per cent of phosphoric acid.

King Crab. Three samples of this material were received and the nitrogen content varied from 7.06 to 9.90, with an average of 8.86 per cent. The content of phosphoric acid varied from 0.91 to 1.44, with an average of 1.13 per cent.

Fish and Tankage. Two samples of this material were examined and had practically the same composition. The average composition is: nitrogen 2.87 per cent and phosphoric acid 7.08 per cent.

Tankage. Thirty-seven samples were examined and the usual variations were noted:

Two samples, Nos. 18310 and 18352, represented a material sold by one manufacturer as "Prepared Tankage." Nearly three-fourths of the nitrogen content was derived from ammonia salts and the organic nitrogen was of low-grade quality. The analysis indicated that this material was not what is known as tankage and the manufacturers decided to discontinue its sale under the brand name as given.

Sample No. 180130 was in such a condition that it was impossible to make the mechanical analysis. This shipment, and also shipments represented by Samples Nos. 18603, 18233, 18305 and 180193, were not accompanied by the required guarantees.

Omitting samples Nos. 18310 and 18352, the content of nitrogen in the samples varied from 3.03 to 8.03, with an average of 5.72 per cent; and the content of phosphoric acid varied from 5.40 to 23.46, with an average of 11.89 per cent.

The mechanical condition of the samples was as variable as the content of nitrogen and phosphoric acid. The finest sample contained 66 per cent, and the coarsest sample contained only 29 per cent of material that was fined than 1/50 inch.

Acid Phosphate. Thirty-eight samples were examined, 24 representing the 16 per cent grade and the remaining 14 samples representing the 14 per cent grade.

The samples of the 16 per cent grade varied from 15.07 to 17.80, with an average of 16.41 per cent of available phosphoric acid. The other samples varied from 12.51 to 17.24, with an average of 14.49 per cent of available phosphoric acid.

Basic Lime Phosphate. The one sample received satisfied its guarantee and contained 13.27 per cent of available phosphoric acid.

NITRATE OF SODA

Station Number	Manufacturer or Dealer and Place of Sampling	Nitrogen	
		Found	Guaranteed
	American Agricultural Chemical Co., New York City.	%	%
18751	A. P. Wooley, Matawan, N. J.	15.09	15.00
	American Fertilizing Co., Baltimore, Md.		
18661	George Elvins, Hammonton, N. J.	14.80	14.82
	Armour Fertilizer Works, Baltimore, Md., and Chrome, N. J.		
18041	J. S. Collins & Son, Inc., Moorestown, N. J.	15.34	14.81
18073	J. W. Heal, Beverly, N. J.	15.27	14.81
	J. H. Baird & Son, Marlboro, N. J.		
18825	J. H. Baird & Son, Marlboro, N. J.	15.30	14.82
	Bowker Fertilizer Co., New York City.		
18289	H. Measley, Elm, N. J.	15.16	.....
	Coe-Mortimer Co., New York City.		
18741	Van Mater & Weigand Trading Co., Hazlet, N. J.	15.09	15.00
	E. Dougherty, Philadelphia, Pa.		
18776	Albert Haines, Moorestown, N. J.	14.40	.....
	Godfrey Co-operative Fert. & Chem. Co., Newark, N. J.		
18491	Palnighi Bros, Vineland, N. J.	15.31	15.00
	Martin Fertilizer Co., Philadelphia, Pa.		
18255	Charles A. Crowley, Blue Anchor, N. J.	15.23	.....
18685	Baron de Hirsch School, Woodbine, N. J.	15.23	14.80
	Monmouth County Farmers Exchange, Freehold, N. J.		
18103	Monmouth County Farmers Exchange, Freehold, N. J.	15.34	14.80
	Nitrate Agencies Co., New York City.		
18620	C. Ronchetti, Vineland, N. J.	15.09	15.00
18606	W. Wilde, Vineland, N. J.	15.31	15.00
	Rasin-Monumental Co., Baltimore, Md.		
18445	M. Feinstein, Bridgeton, N. J.	14.80	14.82
	F. S. Royster Guano Co., Baltimore, Md.		
18738	Collins Bros., Keansburg, N. J.	15.27	15.00
	I. Serata & Sons, Bridgeton, N. J.		
18319	I. Serata & Sons, Bridgeton, N. J.	15.16	.....
	I. P. Thomas & Son Co., Philadelphia, Pa.		
18428	J. J. White, Inc., New Lisbon, N. J.	15.23	15.21
18756	W. Brown, Freneau, N. J.	15.13	15.21
	Trenton Bone Fertilizer Co., Trenton, N. J.		
18132	T. S. Borden, Beverly, N. J.	15.34	15.58
	U. S. Department of Agriculture, Washington, D. C.		
18992	J. H. Hankinson, Glen Moore, N. J.	15.45	.....
	West Jersey Marl and Trans. Co., Woodbury, N. J.		
18279	J. Cliver, Gloucester, N. J.	15.34	14.81
	Average	15.16	.....

15 PER CENT NITRATE OF SODA

	F. W. Tunnell & Co., Inc., Philadelphia, Pa.		
18649	J. H. Lippincott, Moorestown, N. J.	12.20	12.34
180139	H. W. Van Artsdalen, Titusville, N. J.	12.15	12.34
	Average	12.18	.....

SULPHATE OF AMMONIA

Station Number	Manufacturer or Dealer and Place of Sampling	Nitrogen	
		Found	Guaranteed
	Monmouth County Farmers Exchange, Freehold, N. J.	%	%
18104	Monmouth County Farmers Exchange, Freehold, N. J.	19.97	20.50

DRIED BLOOD

Station Number	Manufacturer or Dealer and Place of Sampling	Nitrogen		Phosphoric Acid	
		Found	Guaranteed	Found	Guaranteed
	Baugh & Sons Co., Philadelphia, Pa.	%	%	%	%
18694	*Germania Fruit Growers Union, Germania, N. J.	10.18	11.50	5.40	.....
	Monmouth County Farmers Exchange, Freehold, N. J.				
18106	Monmouth County Farmers Exchange, Freehold, N. J.	12.80	12.75	0.88	.....
	I. P. Thomas & Son Co., Philadelphia, Pa.				
18425	J. J. White, Inc., New Lisbon, N. J.	12.76	12.30	1.11	.....
	Average	12.78	.....	1.00	.....

*Not included in the average. Manufacturers state that error was made in the guarantee attached. Sale was made on the unit basis (9.83 per cent nitrogen).

DRIED AND GROUND FISH

	American Agricultural Chemical Co., New York City.				
18081	College Farm, New Brunswick, N. J.	8.70	8.23	8.06	....
	Nitrate Agencies Co., New York City.				
18605	W. Wilde, Vineland, N. J.	8.24	8.22	6.20	4.57
	Trenton Bone Fertilizer Co., Trenton, N. J.				
18072	J. W. Heal, Beverly, N. J.	8.95	8.20	1.35	.....
18129	T. S. Borden, Beverly, N. J.	9.12	8.20	1.10	.....
	Average	8.75	.....	4.18	.....

CRUDE FISH

	I. P. Thomas & Son Co., Philadelphia, Pa.				
180126	T. R. Hunt, Lambertville, N. J.	7.60	5.75	5.72	3.00

KING CRAB

	A. R. Kohler, Westville, N. J.				
18330	A. R. Kohler, Westville, N. J.	9.90	.....	0.91	....
	Jos. R. Moore, Swedesboro, N. J.				
18331	J. Carter, Thorofare, N. J.	9.61	.....	1.03	....
	I. P. Thomas & Son Co., Philadelphia, Pa.				
18556	Robbins Bros., Swedesboro, N. J.	7.06	8.22	1.44	.....
	Average	8.86	.....	1.13	.....

FISH AND TANKAGE

Station Number	Manufacturer or Dealer and Place of Sampling	Nitrogen		Phosphoric Acid	
		Found	Guaranteed	Found	Guaranteed
	Keystone Bone Fertilizer Co., Philadelphia, Pa.	%	%	%	%
18155	J. E. Chambers, Riverton, N. J.	2.80	3.28	7.13	5.00
18439	G. H. Wilson, Paulsboro, N. J.	2.94	3.28	7.02	5.00
	Average	2.87	.....	7.08	.....

TANKAGE

Station Number	Manufacturer or Dealer and Place of Sampling	Mechanical Analysis		Nitrogen		Phosphoric Acid	
		Finer than 1/50 inch	Coarser than 1/50 inch	Found	Guaranteed	Found	Guaranteed
		%	%	%	%	%	%
	Active Chemical Co., Camden, N. J.						
18310	*H. P. James, Sewell, N. J.	72	28	1.64	1.23	2.63	3.00
18352	*Active Chemical Co, Camden, N. J.	73	27	1.71	1.23	2.58	3.00
	Baugh & Sons Co., Philadelphia, Pa.						
18437	G. A. Rode, Swedesboro, N. J.	54	46	4.30	4.40	18.51	19.26
18202	J. L. Lippincott & Co., Riverton, N. J.	45	55	6.74	6.58	11.60	4.00
18601	W. Wilde, Vineland, N. J.	50	50	6.50	6.58	12.59	4.00
18314	A. S. Clark & Son, Pitman, N. J.	46	54	6.73	5.80	10.06	3.00
18413	W. Frederick, Swedesboro, N. J.	35	65	5.38	5.80	14.52	3.00
18557	W. E. Ashcraft, Swedesboro, N. J.	29	71	5.38	5.80	15.14	3.00
18434	G. A. Rode, Swedesboro, N. J.	48	52	6.75	5.76	11.64	.....
18495	H. L. Sickel, Vineland, N. J.	43	57	5.34	5.76	9.83	3.50
18603	W. Wilde, Vineland, N. J.	37	63	7.32	.....	8.59	.....
	Beckett & Beckett, Swedesboro, N. J.						
18410	W. Davison, Swedesboro, N. J.	52	48	6.19	5.76	11.63	10.00
18571	C. M. Lamson, Repanpo, N. J.	45	55	5.27	4.94	8.69	10.00
	The Berg Co., Philadelphia, Pa.						
18229	T. Schleinkofer, Atco, N. J.	44	56	4.98	4.53	9.89	15.00
	D. Fullerton & Co., Paterson, N. J.						
180130	H. J. Appert & Son, Allendale, N. J.	.....	.....	7.03	.....	6.15	.....
	Godfrey Co-operative Fert. and Chemical Co., Newark, N. J.						
18009?	L. B. Coddington, Murray Hill, N. J.	51	49	5.53	4.94	5.40	12.00
180169	L. W. Smith, Florham Park, N. J.	65	35	7.20	7.40	12.08	6.89

*Material was misbranded. Samples contained 1.20 per cent of nitrogen in form of ammonia salts and the organic nitrogen was of inferior quality.

TANKAGE—(Continued)

Station Number	Manufacturer or Dealer and Place of Sampling	Mechanical Analysis		Nitrogen		Phosphoric Acid	
		Finer than 1/50 inch	Coarser than 1/50 inch	Found	Guaranteed	Found	Guaranteed
		%	%	%	%	%	%
	Heritage & Bro., Mullica Hill, N. J.						
18581	Heritage & Bro., Mullica Hill, N. J.	42	58	4.41	4.90	19.46	12.00
	Locke & Black, Swedesboro, N. J.						
18233	Mrs. F. H. Brewer, Blackwood, N. J.	51	49	6.39	.....	11.59	.....
18305	J. P. Kincaid, Sewell, N. J.	66	34	6.75	.....	12.06	.....
18411	S. Butler, Swedesboro, N. J.	45	55	6.79	6.38	12.37	.....
18438	S. G. Haines, Mickleton, N. J.	50	50	4.93	5.15	11.74	.....
	Martin Fertilizer Co., Philadelphia, Pa.						
18252	Chas. A. Crowley, Blue Anchor, N. J.	46	54	6.84	6.54	8.41	.....
18416	G. A. Rode, Swedesboro, N. J.	35	65	6.03	6.54	8.55	.....
18684	Baron de Hirsch School, Woodbine, N. J.	46	54	6.52	6.54	7.05	.....
18415	G. A. Rode, Swedesboro, N. J.	34	66	4.69	4.94	7.06	.....
	Middlesex Fertilizer Co., Plainfield, N. J.						
180193	Middlesex Fert. Co., Plainfield, N. J.	32	68	6.41	.....	8.20	.....
	Monmouth County Farmers Exchange, Freehold, N. J.						
18105	Monmouth County Farmers Exchange, Freehold, N. J.	48	52	8.03	8.03	7.75	7.00
	Jos. R. Moore, Swedesboro, N. J.						
18332	J. Carter, Thorofare, N. J.	49	51	4.42	4.53	13.61	15.00
18374	S. M. Cook, Paulsboro, N. J.	40	60	4.78	4.53	10.80	15.00
	N. J. Fertilizer and Chemical Co., Jersey City, N. J.						
18747	L. D. Roberts, Keyport, N. J.	58	42	5.71	5.75	7.24	6.87
	Raisin-Monumental Co., Baltimore, Md.						
18444	M. Feinstein, Bridgeton, N. J.	53	47	4.08	5.76	23.46	.....
	Reading Bone Fertilizer Co., Reading, Pa.						
18595	J. E. Gaventa, Pedricktown, N. J.	39	61	5.85	5.75	10.60	9.00
	Scott Fertilizer Co., Elkton, Md.						
18334	L. Leonard, Thorofare, N. J.	48	52	3.03	4.94	19.49	9.16
	I. P. Thomas & Son Co., Philadelphia, Pa.						
18339	A. R. Kohler, Westville, N. J.	48	52	4.87	4.90	16.98	12.00
18363	W. Fink, Mickleton, N. J.	40	60	4.81	4.90	17.84	12.00
18429	J. J. White, Inc., New Lisbon, N. J.	42	58	4.22	4.90	18.21	13.00
	Trenton Bone Fertilizer Co., Trenton, N. J.						
18130	T. S. Borden, Beverly, N. J.	57	43	6.39	6.56	12.76	.....
	West Jersey Marl & Trans. Co., Woodbury, N. J.						
18591	J. Dietrick, Pedricktown, N. J.	53	47	5.09	4.94	8.40	3.00
	Average	46	54	5.72	.....	11.89	.....

16 PER CENT ACID PHOSPHATE

Station Number	Manufacturer or Dealer and Place of Sampling	Phosphoric Acid					
						Available	
		Soluble in Water	Soluble in Ammonium Citrate	Insoluble	Total Found	Found	Guaranteed
	American Agr. Chemical Co., New York City.	%	%	%	%	%	%
18660	P. A. Myrick, Hammonton, N. J........	15.20	1.91	0.63	17.74	17.11	16.00
	Armour Fertilizer Works, Baltimore, Md., and Chrome, N. J.						
180218	Manning Co., Sussex, N. J..............	13.66	1.90	0.52	16.08	15.56	16.00
	Baugh & Sons Co., Philadelphia, Pa.						
18142	Hitchner & Bassett, Woodstown, N. J....	15.22	1.56	0.68	17.46	16.78	16.00
18459	Quinton Glass Co., Quinton, N. J........	15.94	1.51	0.26	17.71	17.45	16.00
18602	W. Wilde, Vineland, N. J...............	13.68	2.49	0.46	16.63	16.17	16.00
180269	Belle Mead Farmers Club, Belle Mead, N. J............................	14.48	2.26	0.15	16.89	16.74	16.00
	Coe-Mortimer Co., New York City.						
18154	L. Horner, Palmyra, N. J...............	14.40	1.68	0.67	16.75	16.08	16.00
	Consumers Chemical Corporation, N. Y. City.						
180145	H. W. Van Artsdalen, Titusville, N. J...	14.00	3.01	0.30	17.31	17.01	16.00
	Godfrey Co-operative Fert. and Chem. Co., Newark, N. J.						
180015	A. G. Cole, Three Bridges, N. J.........	15.14	0.82	0.10	16.06	15.96	16.00
	Martin Fertilizer Co., Philadelphia, Pa.						
18253	Chas. A. Crowley, Blue Anchor, N. J....	15.24	1.92	0.91	18.07	17.16	16.00
18665	Geo. Elvins, Hammonton, N. J..........	10.74	4.99	2.01	17.78	15.73	16.00
18682	Baron de Hirsch School, Woodbine, N. J.	14.04	2.24	1.69	17.97	16.28	16.00
	Nitrate Agencies Co., New York City.						
18082	College Farm, New Brunswick, N. J.....	13.58	2.14	0.62	16.34	15.72	16.00
	Rasin-Monumental Co., Baltimore, Md.						
18447	M. Feinstein, Bridgeton, N. J...........	14.00	2.63	0.73	17.36	16.63	16.00
	Reading Chemical Co., Reading, Pa.						
180158	E. Crowell, Blairstown, N. J............	14.18	2.82	1.51	18.51	17.00	16.00
	F. S. Royster Guano Co., Baltimore, Md.						
18615	C. Ronchetti, Vineland, N. J............	14.60	2.41	0.72	17.73	17.01	16.00
	Swift & Co., Baltimore, Md.						
18551	I. H. Weatherby, Swedesboro, N. J......	11.98	3.98	1.07	17.03	15.96	16.00
	Swift & Co., Kearny, N. J.						
18793	Burlington County Farmers Exchange, Mt. Holly, N. J....................	12.52	2.55	0.52	15.59	15.07	16.00
180221	Armstrong & Demarest, Lafayette, N. J..	12.22	2.93	1.06	16.21	15.15	16.00
	I. P. Thomas & Son Co., Philadelphia, Pa.						
18698	G. Hanselman, Germania, N. J..........	13.40	1.85	1.64	16.89	15.25	16.00
18774	Albert Haines, Moorestown, N. J........	11.60	4.21	1.33	17.14	15.81	16.00
	Trenton Bone Fertilizer Co., Trenton, N. J.						
180121	Lambert & Kerr, Lambertville, N. J.....	15.58	2.22	0.37	18.17	17.80	16.00
	Virginia-Carolina Chemical Co., N. Y. City.						
180025	G. F. Hill & Co., Gladstone, N. J........	14.00	2.77	0.42	17.19	16.77	16.00
	Woodward & Dickerson, Philadelphia, Pa.						
18714	N. E. Diament & Son, Cedarville, N. J...	14.52	2.47	0.34	17.33	16.99	16.00
	Average	.....	.....	.....	.....	16.41	.....

14 PER CENT ACID PHOSPHATE

Station Number	Manufacturer or Dealer and Place of Sampling	Phosphoric Acid					
		Soluble in Water	Soluble in Ammonium Citrate	Insoluble	Total Found	Available: Found	Available: Guaranteed
	American Agr. Chemical Co., New York City.	%	%	%	%	%	%
18228	J. Price, Chews Landing, N. J.	12.06	2.40	0.53	14.99	14.46	14.00
18297	S. Smedley & Son, Glassboro, N. J.	10.30	4.09	0.55	14.94	14.39	14.00
180101	S. S. Baldwin, Murray Hill, N. J.	9.70	4.26	1.80	15.76	13.96	14.00
	Baugh & Sons Co., Philadelphia, Pa.						
18036	F. B. King, Mt. Holly, N. J.	12.80	2.61	0.51	15.92	15.41	14.00
	Godfrey Co-operative Fert. & Chem. Co., Newark, N. J.						
180073	J. W. Snyder, Pittstown, N. J.	12.40	1.55	0.78	14.73	13.95	14.00
	S. M. Hess & Bro., Inc., Philadelphia, Pa.						
18996	A. S. Golden, Hopewell, N. J.	10.98	4.15	0.75	15.88	15.13	14.00
	Listers Agricultural Chemical Works, Newark, N. J.						
180093	A. D. Sutton, Califon, N. J.	11.00	3.18	0.67	14.85	14.18	14.00
	Albert Nelson, Allentown, N. J.						
18918	Albert Nelson, Nelsonville, N. J.	11.36	1.15	0.85	13.36	12.51	14.00
	Ellwood Roberts Co., Philadelphia, Pa.						
18635	Ellwood Roberts Co., Winslow Jct., N. J.	15.82	1.42	0.36	17.60	17.24	14.00
	F. S. Royster Guano Co., Baltimore, Md.						
180081	E. N. Strong, Ringoes, N. J.	10.28	4.11	1.22	15.61	14.39	14.00
	Swift & Co., Kearny, N. J.						
18979	J. T. Van Nest, Martinsville, N. J.	10.60	3.21	0.42	14.23	13.81	14.00
	I. P. Thomas & Son Co., Philadelphia, Pa.						
180067	J. H. Hann, Barbertown, N. J.	9.94	3.90	1.09	14.93	13.84	14.00
	J. E. Tygert Co., Philadelphia, Pa.						
18707	T. I. Grant, Toms River, N. J.	11.52	3.30	0.77	15.59	14.82	14.00
	Virginia-Carolina Chemical Co., N. Y. City.						
18088	College Farm, New Brunswick, N. J.	11.30	3.52	0.73	15.55	14.82	14.00
	Average	.....	....	.....	.....	14.49	.....

BASIC LIME PHOSPHATE

	American Agricultural Chemical Co., New York City.						
180088	F. Welch, Potterstown, N. J.	0.70	12.57	1.88	15.15	13.27	13.00

THE EXAMINATION OF HOME MIXTURES

Five samples of home mixtures were examined, and the results are tabulated on the following pages. The formulas used in preparing these mixtures are:

No. 180129

1000 lbs. Acid Phosphate
1000 lbs. Tankage

No. 18715

200 lbs. Acid Phosphate
50 lbs. Nitrate of Soda
50 lbs. Cottonseed Meal

No. 180128

500 lbs. Acid Phosphate
200 lbs. Ground Bone

No. 180083

2000 lbs. Acid Phosphate
800 lbs. Hen Manure

No. 18657

200 lbs. Nitrate of Soda
200 lbs. Dried Blood
300 lbs. Tankage
200 lbs. Ground Bone
1100 lbs. Acid Phosphate

HOME MIXTURES

Station Number	Prepared By	Address
180129	H. J. Appert & Son	Allendale
18715	N. E. Diament & Son	Cedarville
180128	T. R. Hunt	Lambertville
180083	E. N. Strong	Ringoes
18657	A. S. Walton	Moorestown

HOME MIXTURES

Nitrogen						Phosphoric Acid							Potash	
											Available			
As Nitrates	As Ammonia Salts	As Soluble Organic Matter	As Insoluble Organic Matter	Total Found	Total Guaranteed	Soluble in Water	Soluble in Ammonium Citrate	Insoluble	Total Found	Total Guaranteed	Found	Guaranteed	Found	Guaranteed
Tr.	0.11	0.39	2.90	3.40	.....	5.78	2.35	4.57	12.70	.....	8.13	.....	.....	.....
2.15	0.01	0.22	0.77	3.15	.....	10.78	1.26	0.27	12.31	.....	12.04	.....	.....	.....
Tr.	0.02	0.26	0.38	0.66	.....	5.88	6.29	6.30	18.47	.....	12.17	.....	.....	.....
0.19	0.01	0.11	0.48	0.79	.....	5.46	4.45	0.62	10.53	.....	9.91	.....	0.40	.....
2.17	0.06	0.28	1.68	4.19	.....	5.98	3.34	3.48	12.80	.....	9.32	.....	.....	.....

COMMERCIAL FERTILIZERS

Furnishing Nitrogen, Phosphoric Acid and Potash

Station Number	Manufacturer and Brand	Where Sampled
	Acme Guano Co., Baltimore, Md.	
18256	Potato Climax No. 2	Blackwood
18244	*Potato Climax No. 2	Blackwood
	Active Chemical Co., Camden, N. J.	
18359	Semper Peerless	Camden
18197	Semper Excello	Camden
	American Agricultural Chemical Co., New York City.	
18150	Sampson Potato and Truck Manure	Riverton
18220	*Sampson Potato and Truck Manure	Elmer
18225	Superior Fish Guano for Broadcasting	Laurel Springs
18221	Matchless Potash Manure	Glassboro
18850	All Crop Fish Guano	Hightstown
18935	Odorless Grass and Lawn Top Dressing, Revised	New Brunswick
180213	Bradley's New Method Fertilizer, 1916	Roselle
180174	Bradley's Potato Manure, 1916	Florham Park
18941	Crocker's Universal Grain Grower, 1916	Millstone
180135	Crocker's Harvest Jewel Fertilizer, 1916	Paterson
18566	East India Black Hawk Potato and Truck Fertilizer	Princeton Junction.
18735	East India Corn King, 1916	Red Bank
180105	East India Unexcelled Fertilizer, 1916	Millington
180103	East India Economizer Phosphate, 1916	Millington
180104	East India Potato and Garden Manure	Millington
180029	Great Eastern General, 1916	Bernardsville
18956	Milsom's Potato, Hop and Tobacco Fertilizer, 1916	Bound Brook
18957	Milsom's Wheat, Oats and Barley, 1916	Bound Brook
180148	Northwestern Shawnee Phosphate, 1916	Titusville
180147	Northwestern Diamond Potash Mixture, 1916	Titusville
180149	Northwestern Complete Compound, 1916	Titusville
18983	Packers Union Potato Manure, 1916	Hopewell
18984	Packers Union Superior Crop Grower, 1916	Hopewell
18985	Packers Union Universal Fertilizer, 1916	Hopewell
18703	Read's Farmers' Friend Superphosphate, 1916	Pomerania
18704	Read's Vegetable and Vine Fertilizer, 1916	Pomerania
180016	Read's Leader Fertilizer	Three Bridges
18431	Sharpless & Carpenter's Complete Manure, 1916	Thorofare
18432	Sharpless & Carpenter's Fish Guano, 1916	Thorofare
18613	Sharpless & Carpenter's Vegetable and Potato Manure	Vineland
18912	Sharpless & Carpenter's Soluble Tampico Guano, 1916	Robbinsville
18222	Tygert-Allen's Reliable Crop Grower, 1916	Glassboro
18224	Allen's Sweet Potato Manure, 1916	Blackwood
18298	Allen's Potato and Truck Manure, 1916	Glassboro

* Duplicate sample.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen, Phosphoric Acid and Potash

Nitrogen						Phosphoric Acid							Potash	
											Available			
As Nitrates	As Ammonia Salts	As Soluble Organic Matter	As Insoluble Organic Matter	Total Found	Total Guaranteed	Soluble in Water	Soluble in Ammonium Citrate	Insoluble	Total Found	Total Guaranteed	Found	Guaranteed	Found	Guaranteed
2.64	0.05	0.09	[1]0.15	2.93	3.28	0.70	6.91	0.76	8.37	9.00	7.61	8.00	1.78	2.00
2.58	0.01	0.01	[1]0.19	2.79	3.28	Tr.	6.15	1.84	7.99	9.00	6.15	8.00	2.29	2.00
0.51	0.19	0.03	0.12	0.85	0.82	6.34	3.57	0.65	10.56	11.00	9.91	10.00	1.34	1.00
0.91	0.51	0.02	0.19	1.63	1.64	7.12	3.00	0.60	10.72	11.00	10.12	10.00	1.44	1.00
0.87	0.93	0.51	0.48	2.79	3.29	4.18	4.59	1.16	9.93	9.00	8.77	8.00	2.76	3.00
1.33	1.15	0.20	0.43	3.11	3.29	2.94	5.11	1.51	9.56	9.00	8.05	8.00	*2.90	3.00
0.91	0.98	0.21	0.52	2.62	3.29	1.60	3.56	1.04	6.20	6.00	5.16	5.00	1.25	1.00
0.28	0.55	0.35	0.34	1.52	1.65	2.76	5.38	1.30	9.44	9.00	8.14	8.00	2.06	2.00
....	0.14	0.53	0.50	1.17	1.23	6.76	4.55	1.29	12.60	11.00	11.31	10.00	1.07	1.00
2.50	.....	0.18	0.70	3.38	3.91	4.18	2.06	0.59	6.83	6.00	6.24	5.00	1.64	1.00
....	0.05	0.13	0.62	0.80	0.82	4.94	3.92	1.37	10.23	9.00	8.86	8.00	*1.13	1.00
0.81	0.47	0.49	0.55	2.32	2.47	5.26	3.58	2.78	11.62	10.00	8.84	9.00	1.27	1.00
0.15	0.07	0.13	0.45	0.80	0.82	3.94	4.67	1.09	9.70	9.00	8.61	8.00	*1.10	1.00
0.73	0.05	0.21	0.57	1.56	1.65	7.40	1.78	1.54	10.72	10.00	9.18	9.00	*1.07	1.00
1.55	0.30	0.21	1.07	3.13	3.29	5.30	3.15	1.68	10.13	9.00	8.45	8.00	3.20	3.00
1.30	0.38	0.07	0.61	2.36	2.47	7.54	1.63	1.70	10.87	10.00	9.17	9.00	*1.12	1.00
0.31	0.43	0.29	0.78	1.81	2.06	2.84	5.07	1.76	9.67	9.00	7.91	8.00	*0.96	1.00
Tr.	0.30	0.21	0.43	0.94	0.82	5.10	2.97	1.18	9.25	9.00	8.07	8.00	1.22	1.00
1.54	0.61	0.42	0.61	3.18	3.29	6.74	2.41	1.72	10.87	10.00	9.15	9.00	1.51	1.00
0.16	0.08	0.12	0.32	0.68	0.82	4.82	4.31	1.18	10.31	9.00	9.13	8.00	*0.86	1.00
0.78	0.15	0.41	0.67	2.01	2.06	7.20	3.05	1.53	11.78	11.00	10.25	10.00	1.32	1.00
....	0.03	0.11	0.59	0.73	0.82	4.34	3.54	1.53	9.41	9.00	7.88	8.00	1.22	1.00
0.64	0.40	0.05	0.70	1.79	1.65	5.56	4.52	1.92	12.00	10.00	10.08	9.00	*1.74	1.00
0.31	0.33	0.17	0.69	1.50	1.65	6.14	3.63	1.61	11.38	11.00	9.77	10.00	*1.50	1.00
0.14	0.10	0.16	0.52	0.92	0.82	4.80	3.44	1.11	9.35	9.00	8.24	8.00	*1.49	1.00
0.78	0.17	0.39	0.71	2.05	2.06	7.24	2.95	1.55	11.74	11.00	10.19	10.00	1.29	1.00
Tr.	0.08	0.24	0.34	0.66	0.82	7.20	2.97	0.99	11.16	11.00	10.17	10.00	1.18	1.00
....	0.04	0.13	0.66	0.83	0.82	5.16	3.28	1.42	9.86	9.00	8.44	8.00	1.18	1.00
0.74	0.78	0.12	0.39	2.03	2.06	4.82	2.89	2.13	9.84	9.00	7.71	8.00	*1.55	1.00
1.08	0.99	0.17	0.40	2.64	2.47	5.00	4.39	1.59	10.98	10.00	9.39	9.00	*1.47	1.00
Tr.	0.24	0.18	0.50	0.92	0.82	4.46	3.76	1.86	10.08	9.00	8.22	8.00	*1.46	1.00
Tr.	0.76	0.52	0.48	1.76	1.65	4.86	5.46	1.77	12.09	11.00	10.32	10.00	*1.34	1.00
Tr.	1.02	0.37	0.58	1.97	2.06	5.02	2.58	2.02	9.62	9.00	7.60	8.00	*1.11	1.00
1.06	0.87	0.20	0.25	2.38	2.47	6.30	2.78	1.71	10.79	10.00	9.08	9.00	*1.02	1.00
1.58	0.57	0.37	0.60	3.12	3.29	6.58	2.54	1.80	10.92	10.00	9.12	9.00	*1.26	1.00
0.16	0.57	0.37	0.57	1.67	1.65	4.48	5.42	1.94	11.84	11.00	9.90	10.00	1.22	1.00
0.85	0.61	0.18	0.51	2.15	2.06	4.86	4.43	1.45	10.79	11.00	9.34	10.00	*1.09	1.00
0.71	0.86	0.28	0.54	2.39	2.47	4.98	3.99	1.44	10.41	10.00	8.97	9.00	1.23	1.00

* Potash largely, if not entirely, from sulphate.

[1] Insoluble organic nitrogen of inferior quality.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen, Phosphoric Acid and Potash

Station Number	Manufacturer and Brand	Where Sampled
	American Agricultural Chemical Co., New York City—(Continued)	
18673	Wheeler's Potato Manure, 1916	Cape May
18348	Wheeler's Corn Fertilizer, 1916	Williamstown
18349	Wheeler's Reliable Manure, 1916	Williamstown
180255	Williams & Clark's Special Prolific Crop Producer	W. Hoboken
	American Fertilizing Co., Baltimore, Md.	
18261	American Potato and Truck Guano	Elmer
18420	American Eagle Crop Grower	Westville
18422	American Fish and Potash Compound	Westville
	Armour Fertilizer Works, Baltimore, Md., and Chrome, N. J.	
18148	Armour's 4-8-3	Riverton
18149	Armour's Wheat, Corn and Oats Special	Palmyra
18111	Armour's 4-8-2	Englishtown
18692	Sterling Potato, 1918	Tuckahoe
180219	Armour's Crop Grower	Sussex
180243	Tuscarora Standard	Caldwell
	Baltimore Pulverizing Co., Baltimore, Md.	
18804	Special Potato Mixture	Medford
18054	*Special Potato Mixture	Mt. Holly
18786	Pennimans Special Guano	Mt. Holly
	Baugh & Sons Co., Philadelphia, Pa.	
18005	Baugh's White Potato Special	Cranbury
18388	*Baugh's White Potato Special	Jamesburg
18590	Baugh's Durable Plant Food	Mullica Hill
18461	Baugh's Double Eagle Phosphate	Quinton
18312	Baugh's General Crop Grower for all Crops	Pitman
18209	Baugh's Potato and Truck Special for all Truck Crops	Camden
18713	Baugh's High Grade Potato Grower	Barnegat
180183	Baugh's Special Potato Manure	Stockton
	Bowker Fertilizer Co., New York City.	
18288	Stockbridge Complete	Elm
18284	Bowker's Standard Phosphate	Elm
180178	Bowker's Complete	Stockton
18750	Bowker's Hill and Drill Phosphate, 1916	Matawan
18139	Stockbridge General Crop Manure, 1916	Daretown
18986	Bowker's Lawn and Garden Dressing, 1918	Trenton
180058	Bowker's Farm and Garden Phosphate, 1916	Lebanon
180059	Bowker's Sure Crop Phosphate, 1916	Lebanon
180208	Bowker's Corn Phosphate	Union

* Duplicate sample.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen, Phosphoric Acid and Potash

Nitrogen						Phosphoric Acid							Potash	
											Available			
As Nitrates	As Ammonia Salts	As Soluble Organic Matter	As Insoluble Organic Matter	Total Found	Total Guaranteed	Soluble in Water	Soluble in Ammonium Citrate	Insoluble	Total Found	Total Guaranteed	Found	Guaranteed	Found	Guaranteed
0.71	0.57	0.22	0.54	2.04	2.06	4.58	4.95	1.55	11.08	11.00	9.53	10.00	1.22	1.00
0.26	0.61	0.20	0.45	1.52	1.65	3.40	5.68	1.70	10.78	11.00	9.08	10.00	1.07	1.00
1.73	0.05	0.17	0.33	2.28	2.47	4.68	4.92	1.83	11.43	10.00	9.60	9.00	1.30	1.00
....	0.03	0.23	0.46	0.72	0.82	5.12	3.26	1.15	9.53	9.00	8.38	8.00	1.11	1.00
2.70	0.05	0.24	[1]0.40	3.39	3.29	6.00	2.22	1.03	9.25	9.00	8.22	8.00	*1.87	2.00
....	0.30	0.47	[2]0.86	1.63	1.65	1.90	5.28	2.08	9.26	9.00	7.18	8.00	*2.32	2.00
....	0.18	0.60	0.91	1.69	1.65	1.84	6.07	2.52	10.43	9.00	7.91	8.00	2.98	3.00
....	1.65	0.72	[2]0.80	3.17	3.29	4.56	3.52	1.82	9.90	8.50	8.08	8.00	2.97	3.00
0.14	0.14	0.11	[2]0.31	0.70	0.82	4.52	3.03	0.45	8.00	7.50	7.55	7.00	*1.31	1.00
....	0.31	0.68	1.72	2.71	3.29	2.76	4.39	3.69	10.84	8.50	7.15	8.00	2.18	2.00
....	0.16	0.35	0.44	0.95	0.82	4.46	3.19	1.46	9.11	7.50	7.65	7.00	0.96	1.00
....	0.49	0.21	0.37	1.07	0.82	3.32	4.81	1.03	9.16	8.50	8.13	8.00	2.01	2.00
0.22	0.61	0.10	[1]0.70	1.63	1.65	4.44	4.33	2.14	10.91	8.50	8.77	8.00	2.20	2.00
1.45	0.01	0.11	[3]0.19	1.76	1.64	1.66	5.96	1.04	8.66	8.00	7.62	7.00	1.45	1.00
1.59	0.02	0.08	0.19	1.88	1.64	0.22	4.64	1.21	6.07	8.00	4.86	7.00	1.19	1.00
1.12	0.01	0.08	0.13	1.34	0.82	0.38	6.05	1.30	7.73	9.00	6.43	8.00	1.41	1.00
0.30	1.96	0.45	0.47	3.18	3.30	6.16	2.63	1.97	10.76	8.00	8.79	8.00	2.63	3.00
0.96	1.65	0.07	0.57	3.25	3.30	5.76	3.02	1.84	10.62	8.00	8.78	8.00	2.80	3.00
Tr.	0.63	0.59	0.54	1.76	1.65	6.90	1.36	1.52	9.78	8.00	8.26	8.00	1.53	2.00
....	1.04	0.23	[1]0.50	1.77	1.65	7.18	2.47	1.70	11.35	8.50	9.65	8.50	*0.85	1.00
Tr.	0.10	0.29	[2]0.43	0.82	0.82	5.38	2.79	1.60	9.77	8.00	8.17	8.00	*0.80	1.00
2.11	0.07	0.24	[2]0.41	2.83	2.88	7.40	2.89	1.57	11.86	10.00	10.29	10.00	*1.44	1.00
....	2.44	0.29	0.62	3.35	3.30	8.12	1.61	1.21	10.94	8.00	9.73	8.00	1.09	1.00
Tr.	0.60	0.41	[2]0.49	1.50	1.65	7.92	1.78	1.38	11.08	10.00	9.70	10.00	*1.18	1.00
0.71	1.60	0.06	0.41	2.78	4.11	6.10	4.64	1.28	12.02	11.00	10.74	10.00	3.19	4.00
0.45	0.51	0.27	0.35	1.58	1.65	3.00	4.80	1.46	9.26	9.00	7.80	8.00	1.58	2.00
1.01	0.82	0.31	0.76	2.90	3.29	7.44	3.71	1.01	12.16	11.00	11.15	10.00	2.36	3.00
0.93	0.57	0.37	0.57	2.44	2.47	6.12	3.19	1.30	10.61	10.00	9.31	9.00	1.34	1.00
0.92	1.17	0.50	0.44	3.03	3.29	4.02	5.47	1.55	11.04	10.00	9.49	9.00	1.12	1.00
0.80	0.66	0.36	0.59	2.41	2.47	6.48	2.71	1.03	10.22	9.00	9.19	8.00	1.20	1.00
0.52	0.09	0.32	0.57	1.50	1.65	7.04	3.17	1.64	11.85	11.00	10.21	10.00	1.26	1.00
0.16	0.13	0.11	0.36	0.76	0.82	7.06	2.94	2.05	12.05	11.00	10.00	10.00	1.18	1.00
0.82	0.06	0.28	0.54	1.70	1.65	6.30	4.02	1.25	11.57	11.00	10.32	10.00	1.24	1.00

* Potash largely, if not entirely, from sulphate.

[1] Insoluble organic nitrogen of inferior quality. The excess of total nitrogen partially offsets the amount of inferior quality.

[2] Insoluble organic nitrogen of inferior quality.

[3] Insoluble organic nitrogen of inferior quality. The excess of total nitrogen offsets the amount of inferior quality.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen, Phosphoric Acid and Potash

Station Number	Manufacturer and Brand	Where Sampled
	E. D. Chittendon, Bridgeport, Conn.	
18027	Chittenden's Potato Special with 3% Potash	Cranbury
	Coe-Mortimer Co., New York City.	
18135	E. Frank Coe's H. G. Potato Fertilizer, Revised	Daretown
18632	E. Frank Coe's General Crop Manure, Revised	Grenloch
18576	E. Frank Coe's Empire State Brand, Revised	Repaupo
180226	E. Frank Coe's Red Brand Excelsior Guano, 1916	Elizabeth
18283	E. Frank Coe's Standard Potato Fertilizer, 1916	Elm
18966	E. Frank Coe's Universal Fertilizer, 1916	Pennington
180007	E. Frank Coe's New Englander Special, 1916	Skillman
180227	E. Frank Coe's Gold Brand Excelsior Guano, 1916	Elizabeth
	Columbia Guano Co., Baltimore, Md.	
18790	Columbia Soluble Guano	Lewistown
18841	Columbia Clarion Guano	Englishtown
	Consumers Chemical Corporation, New York City.	
18028	Consumers Pure-Sure Potato and Vegetable with 3% Potash	Cranbury
	Fogg & Hires Co., Salem, N. J.	
18184	Wonder Brand, 1917	Salem
	Forman & Dilatush, Dayton, N. J.	
18010	Forman & Dilatush's Special Potato Manure	Cranbury
	Alex. Forbes & Co., Newark, N. J.	
180237	Perfection Lawn Dressing—War Brand	Newark
	Godfrey Co-operative Fert. & Chem. Co., Newark, N. J.	
18863	Godfrey's Potato Manure, Revised	Jamesburg
18864	*Godfrey's Potato Manure, Revised	Jamesburg
18820	Godfrey's Potato and Truck Fertilizer	Freehold
180071	Godfrey's Spec. Grain and Sure Crop Fertilizer, Revised	Pittstown
180167	Godfrey's Celery and Onion Grower, Revised	Madison
180196	Godfrey's Velvet Lawn Dressing, Revised	Plainfield
180199	Godfrey's General Crop and Corn Fertilizer, Revised	Boonton
180202	Godfrey's Premium Potato Manure, 1917	Boonton
	Thos. Y. Hackett, Daretown, N. J.	
18138	Hackett's Special Fertilizer	Daretown
18213	Hackett's Superior Potato Grower	Elmer
18215	Hackett's Special Phosphate	Monroeville
	Hendrickson & Dilatush, Robbinsville, N. J.	
18390	High Grade Potato Manure, No. 2	Jamesburg
	Heritage & Bro., Mullica, Hill, N. J.	
18587	Pancoast's Royal Fish and Potash Mixture	Mullica Hill

* Duplicate sample.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen, Phosphoric Acid and Potash

Nitrogen						Phosphoric Acid							Potash	
											Available			
As Nitrates	As Ammonia Salts	As Soluble Organic Matter	As Insoluble Organic Matter	Total Found	Total Guaranteed	Soluble in Water	Soluble in Ammonium Citrate	Insoluble	Total Found	Total Guaranteed	Found	Guaranteed	Found	Guaranteed
....	1.74	0.14	1.24	3.12	3.30	2.72	6.29	1.64	10.65	9.00	9.01	8.00	*2.45	3.00
1.32	1.16	0.26	0.36	3.10	3.29	5.26	4.95	1.18	11.39	11.00	10.21	10.00	*2.91	3.00
0.38	0.30	0.12	0.20	1.00	0.82	5.46	3.29	0.73	9.48	9.00	8.75	8.00	*1.82	2.00
0.43	0.57	0.22	0.32	1.54	1.65	2.64	5.38	1.18	9.20	9.00	8.02	8.00	*1.83	2.00
1.16	1.56	0.36	0.84	3.92	4.11	4.46	3.96	1.71	10.13	9.00	8.42	8.00	*1.04	1.00
1.18	0.98	0.34	0.44	2.94	3.29	2.68	6.87	1.38	10.93	10.00	9.55	9.00	1.07	1.00
0.40	0.28	0.21	0.59	1.48	1.65	6.32	3.33	1.47	11.12	10.00	9.65	9.00	*1.12	1.00
Tr.	0.17	0.15	0.36	0.68	0.82	4.50	3.22	1.08	8.80	9.00	7.72	8.00	1.04	1.00
0.93	0.58	0.30	0.48	2.29	2.47	7.20	2.32	1.75	11.37	10.00	9.62	9.00	1.31	1.00
0.29	0.69	0.08	0.55	1.61	1.65	2.64	5.02	2.19	9.85	8.50	7.66	8.00	*1.86	2.00
0.26	1.41	0.53	1.15	3.35	3.29	4.24	4.06	1.77	10.07	8.50	8.30	8.00	*2.73	3.00
....	1.57	0.59	1.39	3.55	3.29	2.60	4.39	3.40	10.39	9.00	6.99	8.00	*3.25	3.00
2.45	0.38	0.13	[1]0.38	3.34	3.29	3.72	4.51	1.65	9.88	8.00	8.23	8.00	*3.30	3.00
....	2.02	0.52	[1]0.77	3.31	3.29	3.94	3.31	2.45	9.70	8.50	7.25	8.00	3.09	3.00
1.67	0.01	0.07	0.68	2.43	2.47	2.42	4.70	5.22	12.34	10.00	7.12	8.00	0.98	1.00
Tr.	1.76	0.22	0.98	2.96	3.29	4.64	4.02	0.62	9.28	9.50	8.66	9.00	1.79	2.00
1.84	0.06	0.02	1.23	3.15	3.29	6.72	2.72	1.39	10.83	9.50	9.44	9.00	2.14	2.00
1.78	0.11	0.39	0.81	3.09	3.29	7.00	2.15	1.77	10.92	8.50	9.15	8.00	*2.86	3.00
....	0.55	0.09	0.55	1.19	0.82	1.96	6.09	1.21	9.26	8.50	8.05	8.00	*1.30	2.00
....	0.72	0.17	[2]0.63	1.52	1.65	2.66	5.48	1.77	9.91	8.50	8.14	8.00	*3.16	3.00
....	1.10	0.29	0.89	2.28	2.47	5.32	2.57	1.05	8.94	8.50	7.89	8.00	*1.32	1.00
Tr.	0.53	0.13	0.88	1.54	1.65	8.32	2.56	1.49	12.37	11.50	10.88	11.00	1.72	1.00
Tr.	0.43	0.66	2.18	3.27	3.29	3.24	4.31	3.52	11.07	8.50	7.55	8.00	2.70	2.00
2.39	1.03	0.08	0.09	3.59	3.28	6.32	3.11	0.90	10.33	9.00	9.43	8.00	*2.67	3.00
3.37	0.05	0.26	[1]0.55	4.23	4.12	6.10	2.12	1.02	9.24	9.00	8.22	8.00	*3.45	3.00
2.66	0.05	0.20	[1]0.59	3.50	3.29	4.82	3.87	0.96	9.65	9.00	8.69	8.00	*3.14	3.00
0.95	1.15	0.43	0.99	3.52	3.29	4.16	5.25	1.94	11.35	11.00	9.41	9.00	*3.05	3.00
....	0.60	0.18	0.89	1.67	1.65	1.64	6.50	2.34	10.48	9.00	8.14	8.00	*3.45	3.00

* Potash largely, if not entirely, from sulphate.

[1] Insoluble organic nitrogen of inferior quality. The excess of total nitrogen partially offsets amount of inferior quality.

[2] Insoluble organic nitrogen of inferior quality.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen, Phosphoric Acid and Potash

Station Number	Manufacturer and Brand	Where Sampled
	S. M. Hess & Bro., Inc., Philadelphia, Pa.	
18475	Fish and Potash Manure, 1916	Greenwich
18476	Potato Manure, 1916	Greenwich
18988	Keystone Phosphate	Hopewell
	International Seed Co., Rochester, N. Y.	
18259	International Special Manure	Elmer
	Keystone Bone Fertilizer Co., Philadelphia, Pa.	
18025	1918 Keystone Supreme Potato and Truck Manure	Perrineville
180085	Keystone Grain and Grass Manure	Ringoes
	Wm. Lancaster, Philadelphia, Pa.	
18321	1918 Grange A Brand Potato Manure	Bridgeton
18765	*1918 Grange A Brand Potato Manure	Bridgeton
	Listers Agricultural Chemical Works, Newark, N. J.	
18927	Listers Corn and Potato Fertilizer, 1916	Robbinsville
18928	Listers 4-8-3	Robbinsville
18929	Listers Perfect Potato Manure, 1916	Robbinsville
18945	Listers U. S. Superphosphate, 1916	Middlebush
18975	Listers Special Crop Producer, 1916	Somerville
180253	Listers Success Fertilizer, 1916	Bloomfield
18732	Listers Standard Pure Superphosphate of Lime, 1916	Red Bank
180146	Listers Valley Brand Fertilizer, 1916	Titusville
180242	Listers Vegetable Compound, 1916	Orange Valley
180240	Listers Lawn Fertilizer, 1916	Orange Valley
180241	Listers Potato Manure, 1916	Orange Valley
	Locke and Black, Swedesboro, N. J.	
18523	Atkinson's No. 4 Spec. Sweet Potato Fertilizer	Swedesboro
18175	Atkinson's No. 1½ Spec. White Potato Fertilizer	Salem
	Frederick Ludlam Co., New York City.	
180249	Ludlam's General Fertilizer	Caldwell
	Mapes Formula & Peruvian Guano Co., New York City.	
18471	Mapes' Potato Manure, 1916 Brand	Greenwich
18696	Mapes' Top Dresser, Full Strength, 1916 Brand	Germania
180026	Mapes' Corn Manure, 1916 Brand	Gladstone
	Martin Fertilizer Co., Philadelphia, Pa.	
18663	Martin's Bull Head Fertilizer	Hammonton
18664	Martin's 4-8-3	Hammonton
	Monmouth County Farmers Exchange, Freehold, N. J.	
18060	Triangle Brand 4-8-3	Mt. Holly

* Error made in shipment. Material paid for in accordance with the analysis.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen, Phosphoric Acid and Potash

Nitrogen						Phosphoric Acid							Potash	
											Available			
As Nitrates	As Ammonia Salts	As Soluble Organic Matter	As Insoluble Organic Matter	Total Found	Total Guaranteed	Soluble in Water	Soluble in Ammonium Citrate	Insoluble	Total Found	Total Guaranteed	Found	Guaranteed	Found	Guaranteed
0.15	0.87	0.11	0.54	1.67	1.65	2.06	6.08	2.13	10.27	10.00	8.14	9.00	0.98	1.00
1.21	0.73	0.15	0.35	2.44	2.47	5.20	5.03	1.48	11.71	10.00	10.23	9.00	1.51	1.00
....	0.05	0.12	0.59	0.76	0.82	4.62	3.44	1.57	9.63	9.00	8.06	8.00	1.25	1.00
....	0.70	0.40	0.51	1.61	1.65	4.74	5.37	1.83	11.94	11.00	10.11	10.00	*1.51	1.00
....	1.58	0.45	0.56	2.59	3.28	5.94	3.21	0.85	10.00	9.00	9.15	8.00	*1.26	2.00
....	0.33	0.06	0.41	0.80	0.82	0.42	5.40	2.96	8.78	8.00	5.82	7.00	*0.75	1.00
0.58	1.04	0.45	0.84	2.91	3.30	4.84	3.91	1.19	9.94	9.00	8.75	8.00	*2.42	2.00
....	2.27	0.33	0.71	3.31	3.30	6.74	3.00	0.84	10.58	9.00	9.74	8.00	*0.35	2.00
0.75	0.22	0.33	0.75	2.05	2.06	6.34	2.39	1.54	10.27	9.00	8.73	8.00	*1.20	1.00
1.61	1.08	0.20	0.57	3.46	3.29	4.02	4.40	1.72	10.14	9.00	8.42	8.00	*2.75	3.00
1.10	0.62	0.52	0.98	3.22	3.29	5.14	3.81	2.19	11.14	10.00	8.95	9.00	*1.08	1.00
0.21	0.10	0.59	0.43	1.33	1.23	7.62	3.65	1.78	13.05	11.00	11.27	10.00	*0.97	1.00
Tr.	0.11	0.27	0.38	0.76	0.82	4.17	4.53	1.75	10.45	9.00	8.70	8.00	*0.58	1.00
0.25	0.12	0.29	0.52	1.18	1.23	6.56	3.38	2.25	12.19	11.00	9.94	10.00	1.04	1.00
1.12	0.48	0.35	0.50	2.45	2.47	8.64	1.37	0.89	10.90	10.00	10.01	9.00	*1.53	1.00
....	0.08	0.14	0.56	0.78	0.82	7.26	3.94	1.84	13.04	11.00	11.20	10.00	*1.11	1.00
1.54	1.47	0.43	0.56	4.00	4.11	5.46	2.75	2.03	10.24	9.00	8.21	8.00	*1.27	1.00
0.67	0.27	0.55	0.59	2.08	2.06	5.96	1.76	1.65	9.37	9.00	7.72	8.00	*1.41	1.00
1.20	1.55	0.65	0.66	4.06	4.11	4.90	3.24	1.77	9.91	9.00	8.14	8.00	*1.14	1.00
....	0.54	0.20	0.76	1.50	1.65	2.20	5.99	2.77	10.96	9.00	8.19	8.00	*3.04	3.00
2.38	0.05	0.25	[2]0.68	3.36	3.29	3.34	4.28	1.07	8.69	9.00	7.62	8.00	*3.44	3.00
1.02	0.48	0.26	0.52	2.28	2.47	6.76	2.08	2.94	11.78	10.00	8.84	9.00	1.31	1.00
3.09	0.02	0.13	[1]0.44	3.68	3.71	2.42	5.91	2.05	10.38	8.00	8.33	8.00	*1.45	1.00
10.54	0.02	0.02	0.20	10.78	9.88	0.52	4.98	1.74	7.24	8.00	5.50	5.00	*1.89	1.00
1.97	0.02	0.11	[2]0.50	2.60	2.47	.....	7.58	4.47	12.05	10.00	7.58	8.00	*1.32	1.00
2.72	0.03	0.03	[3]0.39	3.17	2.47	0.68	6.01	2.27	8.96	9.00	6.69	8.00	*1.36	1.00
1.69	0.03	0.09	[1]0.39	2.20	3.30	0.04	7.33	2.22	9.59	9.00	7.37	8.00	*2.85	3.00
1.50	0.86	0.47	0.64	3.47	3.29	2.84	5.57	2.54	10.95	9.00	8.41	8.00	*3.24	3.00

* Potash largely, if not entirely, from sulphate.

[1] Insoluble organic nitrogen of inferior quality.

[2] Insoluble organic nitrogen of inferior quality. The excess of total nitrogen partially offsets amount of inferior quality.

[3] Insoluble organic nitrogen of inferior quality. The excess of total nitrogen offsets amount of inferior quality.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen, Phosphoric Acid and Potash

Station Number	Manufacturer and Brand	Where Sampled
	J. R. Moore, Swedesboro, N. J.	
18514	J. R. Moore's H. G. Potash Sweet Potato Manure	Swedesboro
18516	J. R. Moore's Early Truck and Potato Manure	Swedesboro
18478	J. R. Moore's 2-8-2 Sweet Potato Manure	Swedesboro
18479	J. R. Moore's Superior Gold Edge Sweet Potato Manure	Swedesboro
18481	J. R. Moore's Baxter Special Tomato Grower	Swedesboro
	Nassau Fertilizer Co., New York City.	
18234	Nassau Special, 1916	Atco
18949	General Favorite Fish Mixture	Bound Brook
180096	Wheat and Grass Grower, 1916	New Germantown
	Albert Nelson, Allentown, N. J.	
18914	Nelson's Special Fish and Potash	Nelsonville
18919	Nelson's H. G. Potato Phosphate	Nelsonville
	Patapsco Guano Co., Baltimore, Md.	
18767	Patapsco Fish Guano, 1916	Red Bank
	Rasin-Monumental Co., Baltimore, Md.	
18180	Rasin's Electric Truck and Vegetable Manure	Salem
18451	Rasin's Champion Potato and Vegetable Manure	Bridgeton
18630	Rasin's H. G. Potato and Truck Manure	Evesboro
	Reading Bone Fertilizer Co., Reading, Pa.	
18593	Blood, Meat and Potash Mixture	Pedricktown
	Ellwood Roberts Co., Philadelphia, Pa.	
18633	Jersey Special	Winslow Junction
	F. S. Royster Guano Co., Baltimore, Md.	
18029	Royster's True Blue Compound	Robbinsville
18185	*Royster's True Blue Compound	Salem
18562	Royster's Fish, Flesh and Fowl Phosphate	Swedesboro
18833	Royster's Dreadnought Fertilizer	Tennent
18835	Royster's Big Bet Fertilizer	Tennent
	Schanck, Hutchinson & Field, Hightstown, N. J.	
18855	Davison's Fish and Potash Mixture for Potatoes	Hightstown
	Scott Fertilizer Co., Elkton, Md.	
18455	W. R. Hackett's No. 1 Special Potato Manure	Quinton
	Harry L. Sockel, Woodbury, N. J.	
18496	E. Sickel's 2-8-2 for Sweet and White Potatoes	Vineland
18499	B. Sickel's 1-8-1 Special for Sweet Potatoes	Vineland

* Duplicate sample.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen, Phosphoric Acid and Potash

Nitrogen						Phosphoric Acid							Potash	
											Available			
As Nitrates	As Ammonia Salts	As Soluble Organic Matter	As Insoluble Organic Matter	Total Found	Total Guaranteed	Soluble in Water	Soluble in Ammonium Citrate	Insoluble	Total Found	Total Guaranteed	Found	Guaranteed	Found	Guaranteed
0.67	0.01	0.01	0.17	0.86	0.82	7.14	1.87	0.50	9.51	9.00	9.01	8.00	4.72	5.00
3.15	0.02	0.03	0.18	3.38	3.29	4.58	4.24	0.82	9.64	9.00	8.82	8.00	*2.46	2.00
1.40	0.03	.....	0.16	1.59	1.65	1.80	6.83	0.80	9.43	9.00	8.63	8.00	*2.25	2.00
1.32	0.02	0.10	0.21	1.65	1.65	7.50	1.60	0.42	9.52	9.00	9.10	8.00	*3.03	3.00
3.65	0.01	0.14	[1]0.21	4.01	3.70	3.52	3.90	0.69	8.11	8.00	7.42	7.00	*1.58	1.00
1.18	0.70	0.19	0.39	2.46	2.47	5.74	3.81	1.51	11.06	10.00	9.55	9.00	1.28	1.00
0.24	0.14	0.17	0.77	1.32	1.23	6.88	3.52	1.60	12.00	11.00	10.40	10.00	1.17	1.00
0.20	0.32	0.07	0.41	1.00	0.82	4.92	3.10	1.34	9.36	9.00	8.02	8.00	1.00	1.00
1.08	0.02	0.10	[3]0.37	1.57	1.65	6.90	1.37	0.68	8.95	9.50	8.27	8.50	0.80	1.00
2.03	0.07	0.21	[3]0.80	3.11	3.29	5.00	3.23	1.12	9.35	9.00	8.23	8.00	3.36	3.00
0.15	0.12	0.14	0.71	1.12	1.23	6.10	3.67	2.46	12.23	11.00	9.77	10.00	*1.73	1.00
2.83	0.04	0.18	0.46	3.51	4.12	7.80	1.13	0.85	9.78	9.00	8.93	8.00	3.25	3.00
2.16	0.05	0.27	[3]0.54	3.02	3.29	4.40	3.69	1.17	9.26	9.00	8.09	8.00	3.12	3.00
2.61	0.03	0.17	[3]0.41	3.22	3.29	6.08	2.03	1.12	9.23	9.00	8.11	8.00	1.85	2.00
....	0.75	0.63	0.41	1.79	1.64	2.90	5.51	1.70	10.11	9.00	8.41	8.00	1.99	2.00
0.14	0.17	.....	0.48	0.79	0.82	3.96	3.80	1.02	8.78	8.00	7.76	8.00	1.12	1.00
....	2.03	0.46	0.67	3.16	3.29	3.88	4.32	1.34	9.54	8.50	8.20	8.00	*3.14	3.00
....	1.89	0.32	0.98	3.19	3.29	3.40	4.84	2.20	10.44	8.50	8.24	8.00	*2.88	3.00
0.12	0.96	0.41	[1]0.39	1.88	1.65	4.84	3.93	1.06	9.83	8.50	8.77	8.00	*2.80	3.00
Tr.	0.88	0.32	0.54	1.74	1.65	4.12	3.73	1.65	9.50	8.50	7.85	8.00	*2.58	2.00
Tr.	1.66	0.21	1.24	3.11	3.29	4.56	4.13	1.34	10.03	8.50	8.69	8.00	*2.34	2.00
2.41	0.19	0.15	0.25	3.00	3.29	5.06	3.67	1.37	10.10	9.00	8.73	8.00	2.99	3.00
1.87	0.16	0.38	1.53	3.94	4.10	Tr.	7.79	1.74	9.53	12.00	7.79	10.00	5.34	5.00
Tr.	0.74	0.43	[2]0.57	1.74	1.65	6.28	2.33	1.72	10.33	8.00	8.61	8.00	1.75	2.00
....	0.12	0.41	[2]0.39	0.92	0.82	6.90	2.08	1.01	9.99	8.00	8.98	8.00	*1.27	1.00

* Potash largely, if not entirely, from sulphate.

[1] Insoluble organic nitrogen of inferior quality. Excess of total nitrogen offsets the amount of inferior quality.

[2] Insoluble organic nitrogen of inferior quality. Excess of total nitrogen partially offsets the amount of inferior quality.

[3] Insoluble nitrogen of inferior quality.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen, Phosphoric Acid and Potash

Station Number	Manufacturer and Brand	Where Sampled
	South Jersey Farmers Exchange, Woodstown, N. J.	
18609	A 3% Exchange Special H. G. Potato Fertilizer	Bridgeton
18548	B 3% Exchange Special White Potato Manure	Daretown
18442	B 5% Exchange Extra Special Potato Fertilizer	Bridgeton
18608	D 3% Exchange Extra White Potato Fertilizer	Woodstown
18550	|B 3%| Exchange Special White Potato Fertilizer	Elmer
18527	|E 5%| Exchange Special Sweet Potato Fertilizer	Woodstown
18529	:B:3% Exchange Special White Potato Fertilizer	Woodstown
18523	:E:2% Exchange Sweet Potato Fertilizer	Woodstown
18526	:E:5% Exchange Special Sweet Potato Fertilizer	Woodstown
18506	*:E:5% Exchange Special Sweet Potato Fertilizer	Swedesboro
18545	B 3% X Exchange Special White Potato Fertilizer	Woodstown
18546	*B 3% X Exchange Special White Potato Fertilizer	Woodstown
18544	(B 3%) Exchange Special White Potato Fertilizer	Elmer
18267	South Jersey Farmers Exchange 4-8-3	Elmer
	Standard Guano Co., Baltimore, Md.	
18759	4-8-3	Bridgeton
18762	4-8-2	Bridgeton
	Swift & Co., Baltimore, Md.	
18257	Swift's Red Steer	Elmer
18538	*Swift's Red Steer	Vineland
18559	Swift's White Potato Fertilizer	Swedesboro
	Swift & Co., Kearny, N. J.	
18026	Swift's Market Garden Manure	Perrineville
18045	Holley Market Garden Manure	Mt. Holly
18723	Swift's Garden and Truck Fertilizer	Lakewood
18977	Swift's Truck and Vegetable Fertilizer	Martinsville
180036	Swift's Corn Grower	Gladstone
180050	Swift's Standard Potato Fertilizer	Far Hills
	Taylor Bros., Camden, N. J.	
18205	High Grade Potato Phosphate	Camden
18206	T. B. Superior Ammoniated Phosphate	Camden
	I. P. Thomas & Son Co., Philadelphia, Pa.	
18340	Potato Manure with 2% Potash	Thorofare
18426	Truckers' High Grade Manure	New Lisbon
18655	Special Mixture No. 2 (formula given)	Moorestown
180123	I. P. Thomas' 4-8-3 Fertilizer	Lambertville
180064	Superior Superphosphate	Barbertown
180065	Grain Special Fertilizer	Barbertown
18364	Tip Top Fertilizer	Mickleton

* Duplicate sample.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen, Phosphoric Acid and Potash

Nitrogen						Phosphoric Acid							Potash	
											Available			
As Nitrates	As Ammonia Salts	As Soluble Organic Matter	As Insoluble Organic Matter	Total Found	Total Guaranteed	Soluble in Water	Soluble in Ammonium Citrate	Insoluble	Total Found	Total Guaranteed	Found	Guaranteed	Found	Guaranteed
....	2.20	0.21	1.45	3.86	4.11	8.80	1.52	0.84	11.16	11.00	10.32	10.00	*2.91	3.00
....	1.84	0.38	0.99	3.21	3.29	3.88	4.60	1.79	10.27	9.00	8.48	8.00	*3.12	3.00
1.82	0.23	0.17	0.91	3.13	3.29	7.08	2.05	1.70	10.83	9.00	9.13	8.00	*4.72	5.00
Tr.	1.94	0.42	1.83	4.19	4.11	4.44	4.56	1.41	10.41	9.00	9.00	8.00	*2.85	3.00
1.97	0.06	0.34	0.80	3.17	3.29	6.90	2.01	1.54	10.45	9.00	8.91	8.00	*3.21	3.00
....	0.22	0.42	0.64	1.28	0.82	1.78	6.33	2.46	10.57	9.00	8.11	8.00	*4.51	5.00
0.91	1.36	0.09	1.00	3.36	3.25	3.52	4.90	1.34	9.76	9.00	8.42	8.00	*3.06	3.00
Tr.	1.51	0.20	[3]0.55	2.26	1.65	2.88	4.98	1.09	8.95	9.00	7.86	8.00	*2.34	2.00
0.49	0.06	0.25	[3]0.37	1.17	0.82	Tr.	8.29	2.15	10.44	9.00	8.29	8.00	4.95	5.00
0.61	0.09	0.03	[3]0.37	1.10	0.82	4.22	3.52	2.91	10 65	9.00	7.74	8.00	*5.48	5.00
2.08	0.06	0.36	0.95	3.45	3.29	6.56	2.87	0.93	10.36	9.00	9.43	8.00	*2.67	3.00
1.86	0.06	0.80	0.60	3.32	3.29	4.76	3.61	1.50	9.87	9.00	8.37	8.00	*3.03	3.00
0.80	0.89	0.23	1.61	3.53	3.29	2.18	5.37	2.42	9.97	9.00	7.55	8.00	3.14	3.00
1.75	0.14	0.83	0.71	3.43	3.29	4.96	3.10	1.78	9.84	8.50	8.06	8.00	*3.05	3.00
1.56	0.07	0.16	[2]1.14	2.93	3.29	6.18	3.16	0.54	9.88	.....	9.34	8.00	*2.73	3.00
1.66	0.04	0.13	1.30	3.13	3.29	6.02	2.71	0.48	9.21	.....	8.73	8.00	2.23	2.00
0.55	0.20	0.08	[2]0.73	1.56	1.65	5.44	3.17	0.93	9.54	8.00	8.61	8.00	1.91	2.00
0.68	0.08	0.13	[1]0.84	1.73	1.65	4.38	4.08	1.80	10.26	8.00	8.46	8.00	2.05	2.00
Tr.	2.38	0.38	0.57	3.33	3.29	3.18	5.00	2.17	10.35	8.00	8.18	8.00	2.44	3.00
....	2.09	0.16	0.80	3.05	3.29	2.46	4.96	1.86	9.28	8.00	7.42	8.00	3.36	3.00
0.38	1.69	0.25	0.86	3.18	3.29	4.16	3.59	1.68	9.43	8.00	7.75	8.00	*3.16	3.00
0.35	1.62	0.30	0.76	3.03	3.29	5.76	2.03	0.84	8.63	8.00	7.79	8.00	1.53	1.00
0.33	0.72	0.12	0.76	1.93	1.65	5.30	5.22	1.64	12.16	8.00	10.52	8.00	0.75	1.00
Tr.	0.18	0.37	0.93	1.48	1.65	3.63	6.38	2.34	12.35	10.00	10.01	10.00	0.82	1.00
0.33	0.26	0.10	1.18	1.87	1.65	4.40	3.36	0.97	8.73	8.00	7.76	8.00	1.97	3.00
0.16	0.93	0.22	[1]0.50	1.81	1.65	8.10	1.97	1.41	11.48	10.00	10.07	10.00	1.16	1.00
0.56	0.15	0.40	[2]0.51	1.62	1.65	7.42	2.01	1.39	10.82	8.00	9.43	8.00	1.01	1.00
1.03	1.45	0.14	0.79	3.41	3.25	1.52	7.28	1.54	10.34	8.50	8.80	8.00	*2.32	2.00
1.22	1.30	0.08	0.52	3.12	3.25	4.20	4.58	1.45	10.23	8.50	8.78	8.00	*1.33	1.00
1.22	0.22	0.31	1.17	2.92	.....	2.76	5.09	2.41	10.26	.....	7.85	.....	2.24	.....
0.65	1.31	0.18	0.88	3.02	3.25	4.08	4.62	1.52	10.22	8.50	8.70	8.01	3.01	3.00
....	0.05	0.19	[1]0.61	0.85	0.82	0.62	5.66	3.87	10.15	7.50	6.28	7.00	*1.04	1.00
0.66	0.04	0.13	[2]0.19	1.02	0.82	0.48	6.74	1.98	9.20	8.50	7.22	8.00	2.00	2.00
0.96	1.17	0.11	0.54	2.78	2.45	3.96	4.01	1.29	9.26	8.50	7.97	8.00	1.22	1.00

* Potash largely, if not entirely, from sulphate.

[1] Insoluble organic nitrogen of inferior quality. Excess of total nitrogen partially offsets the amount of inferior quality.

[2] Insoluble organic nitrogen of inferior quality.

[3] Insoluble organic nitrogen of inferior quality. Excess of total nitrogen offsets the amount of inferior quality.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen, Phosphoric Acid and Potash

Station Number	Manufacturer and Brand	Where Sampled
	Trenton Bone Fertilizer Co., Trenton, N. J.	
18133	4-8-3 Potato	Beverly
	F. W. Tunnell & Co., Inc., Philadelphia, Pa.	
18007	1918 Special Potato Manure	Allentown
18391	Monmouth's Pride Potato Manure	Cranbury
18101	*Monmouth's Pride Potato Manure	Freehold
18009	Robbinsville Potato Special	Allentown
18181	1918 Pride of Jersey	Salem
18204	Special Mixture	Beverly
18269	1918 Sweet Potato Manure	Westville
18350	1918 Truck Manure	Williamstown
18351	1918 Jersey Potato Manure	Williamstown
	J. E. Tygert Co., Philadelphia, Pa.	
18533	Standard Fertilizer	Vineland
18535	Sweet Potato Guano, 1916	Vineland
18536	Paramount Potato and Truck Manure, 1916	Vineland
18868	Golden Harvest Phosphate, 1916	Burlington
	Virginia-Carolina Chemical Co., New York City.	
18024	C & B XXXX Fish and Potash Potato Manure with 3% Potash	Perrineville
18894	*C & B XXXX Fish and Potash Potato Manure with 3% Potash	Cranbury
18031	V. C. C. Co.'s Double Owl Brand Potato and Truck Fertilizer with 3% Potash	Englishtown
18085	V. C. C. Co.'s Universal Fertilizer for all Crops	Beverly
18517	*V. C. C. Co.'s Universal Fertilizer for all Crops	Swedesboro
18264	V. C. C. Co.'s Owl Brand Potato and Truck Fertilizer with 3% Potash	Elmer
18084	V. C. C. Co.'s XXXX Fish and Potato Mixture	Beverly
18814	V. C. C. Co.'s Double Owl Brand Potato and Truck Fertilizer with 1% Potash	Freehold
	West Jersey Marl and Transportation Co., Woodbury, N. J.	
18144	Early Potato Manure	Daretown
18162	1-8-3 Brand	Delair
18273	Special Sweet Potato Manure	Woodbury
18336	Tomato and Potato Manure	Thorofare
18276	High Grade Truck Manure	Gloucester
18335	All Crop Mixture	Thorofare
18368	2-8-2 Brand	Thorofare
	J. R. Wyckoff, Princeton Junction, N. J.	
18567	Wyckoff's Special Potato Fertilizer	Princeton Junction.
18569	Wyckoff's Market Garden Manure	Princeton Junction.

* Duplicate sample.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen, Phosphoric Acid and Potash

Nitrogen						Phosphoric Acid							Potash	
											Available			
As Nitrates	As Ammonia Salts	As Soluble Organic Matter	As Insoluble Organic Matter	**Total Found**	**Total Guaranteed**	Soluble in Water	Soluble in Ammonium Citrate	Insoluble	**Total Found**	**Total Guaranteed**	**Found**	**Guaranteed**	**Found**	**Guaranteed**
1.60	0.43	0.42	0.69	3.14	3.28	6.30	2.61	1.54	10.45	9.00	8.91	8.00	*2.85	3.00
....	1.86	0.50	0.78	3.14	3.30	4.06	4.08	1.52	9.66	9.00	8.14	8.00	3.10	3.00
0.62	1.30	0.33	0.90	3.15	3.30	3.06	5.24	1.12	9.42	9.00	8.30	8.00	2.35	2.00
....	2.07	0.15	0.70	3.22	3.30	3.08	5.22	0.88	9.18	9.00	8.30	8.00	1.99	2.00
....	1.73	0.67	0.70	3.10	3.30	4.76	3.55	1.20	9.51	9.00	8.31	8.00	3.74	4.00
....	1.32	0.58	1.23	3.13	3.30	3.16	4.10	2.42	9.68	8.00	7.26	7.00	*2.05	2.00
1.09	0.11	0.14	[1]1.03	2.37	2.46	1.76	2.99	0.66	5.41	.....	4.75	5.00	*0.88	0.50
0.43	0.74	0.19	0.57	1.93	1.64	1.08	6.31	2.61	10.00	9.00	7.39	8.00	*1.83	2.00
....	1.79	0.74	0.79	3.32	4.12	1.64	5.86	1.81	9.31	7.00	7.50	6.00	1.04	1.00
....	1.83	0.60	0.84	3.27	3.30	1.36	5.60	2.26	9.22	9.00	6.96	8.00	*1.25	1.00
0.44	0.49	0.20	0.37	1.50	1.65	2.80	4.73	1.68	9.21	9.00	7.53	8.00	1.81	2.00
....	0.41	0.43	0.42	1.26	1.23	4.48	5.45	2.29	12.22	11.00	9.93	10.00	1.23	1.00
1.46	1.09	0.11	0.46	3.12	3.29	2.64	5.53	1.49	9.66	9.00	8.17	8.00	2.84	3.00
Tr.	0.21	0.42	0.35	0.98	0.82	5.12	3.21	0.96	9.29	9.00	8.33	8.00	1.10	1.00
1.88	0.94	0.02	[1]0.31	3.15	3.29	6.22	2.04	0.36	8.62	9.00	8.26	8.00	*3.01	3.00
0.21	1.80	0.46	0.77	3.24	3.29	2.04	5.69	2.07	9.80	9.00	7.73	8.00	*3.06	3.00
0.15	1.79	0.72	0.72	3.38	3.29	2.14	5.56	1.78	9.48	9.00	7.70	8.00	*4.04	3.00
Tr.	0.50	0.36	0.24	1.10	0.82	0.82	8.09	2.27	11.18	10.00	8.91	9.00	*3.17	3.00
1.47	0.14	0.27	0.63	2.51	0.82	7.60	1.73	0.80	10.13	10.00	9.33	9.00	1.38	3.00
1.43	0.08	0.21	0.09	1.81	1.65	5.70	2.93	0.55	9.18	9.00	8.63	8.00	*2.81	3.00
0.76	0.32	0.08	0.32	1.48	1.65	6.02	2.91	1.12	10.05	9.00	8.93	8.00	1.34	1.00
2.75	.....	0.36	0.66	3.77	3.29	4.70	2.48	0.82	8.00	9.00	7.18	8.00	*1.62	1.00
0.92	1.74	0.09	[2]0.54	3.29	3.28	6.16	2.15	1.47	9.78	8.00	8.31	8.00	*3.34	3.00
Tr.	0.18	0.42	[2]0.48	1.08	0.82	5.68	2.40	1.80	9.88	8.00	8.08	8.00	*2.78	3.00
....	1.04	0.10	[1]0.50	1.64	1.65	6.92	3.02	1.77	11.71	9.00	9.94	9.00	0.90	1.00
0.91	1.20	0.10	0.52	2.73	2.87	7.88	2.47	1.67	12.02	10.00	10.35	10.00	1.29	1.00
0.24	2.09	0.18	[1]0.62	3.13	3.28	7.28	1.58	1.46	10.32	8.00	8.86	8.00	1.13	1.00
0.71	0.22	0.21	0.81	1.95	2.05	4.02	2.53	3.03	9.58	6.00	6.55	6.00	1.09	1.00
0.13	0.76	0.53	[3]0.52	1.94	1.65	7.16	1.65	1.56	10.37	8.00	8.81	8.00	*1.60	2.00
....	1.78	0.36	0.80	2.94	3.29	4.96	3.15	1.50	9.61	8.00	8.11	8.00	2.85	3.00
1.92	0.18	0.22	0.66	2.98	3.29	3.30	4.74	1.72	9.76	8.00	8.04	8.00	*3.20	3.00

* Potash largely, if not entirely, from sulphate.

[1] Insoluble organic nitrogen of inferior quality.

[2] Insoluble organic nitrogen of inferior quality. Excess of total nitrogen partially offsets the amount of inferior quality.

[3] Insoluble organic nitrogen of inferior quality. Excess of total nitrogen offsets the amount of inferior quality.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen and Phosphoric Acid

Station Number	Manufacturer and Brand	Where Sampled
	Acme Guano Co., Baltimore, Md.	
18430	Perfect Potato	Westville
18573	Ammoniated Fish Guano No. 1	Repaupo
18577	Acme Early Truck No. 1	Repaupo
	Active Chemical Co., Camden, N. J.	
18396	Semper Potato King Fertilizer	Salem
18358	Semper Corn Grower	Camden
18353	Semper All Crop Fertilizer	Camden
18198	Semper Condor	Camden
18360	Semper Special Fertilizer	Camden
18356	Semper Active Fertilizer	Camden
18344	Semper Premium Fertilizer	Sewell
	American Agricultural Chemical Co., New York City.	
180045	Ammoniated Fertilizer A	Neshanic
18637	Ammoniated Fertilizer AA	Woodbury
18675	Ammoniated Fertilizer AAA	Cape May
18243	Ammoniated Fertilizer AAAA	Blackwood
180112	High Grade Ammoniated Fertilizer	River Edge
18227	Superphosphate with Ammonia 4 Per Cent	Chews Landing
18219	XXX Ammoniated Fertilizer	Elmer
18247	Great Truck Special	Blackwood
180046	Soluble Grain Mixture	Neshanic
180211	Special Potato Phosphate	Roselle
18887	Bradley's Special Superior Compound, Revised	Plainsboro
180212	Bradley Truckers' Delight	Roselle
18094	Crocker's Champion Potato Grower	Marlboro
180247	Crocker's Special Colonial Fertilizer, Revised	Orange
18095	East India Victor Special, 1916	Marlboro
18733	East India Special Improved Compound	Red Bank
18736	East India Early Market	Red Bank
180136	Milsom's Golden Eagle	Paterson
180137	Milsom's Potato Producer	Paterson
180107	Potomac Top Dressing Manure	Bernardsville
18387	Read's Top Notch Mixture	Cranbury
180017	Read's Practical Grain Grower	Three Bridges
18851	Read's Farm and Garden Manure	Hightstown
18237	Sharpless & Carpenter's Gold Seal Potato Manure	Blackwood
18611	Sharpless & Carpenter's Grain Mixture	Vineland
180164	Sharpless & Carpenter's Practical Guano	Hainesburg

COMMERCIAL FERTILIZERS

Furnishing Nitrogen and Phosphoric Acid

Manufacturer and Brand						Phosphoric Acid					Available	
As Nitrates	As Ammonia Salts	As Soluble Organic Matter	As Insoluble Organic Matter	Total Found	Total Guaranteed	Soluble in Water	Soluble in Ammonium Citrate	Insoluble	Total Found	Total Guaranteed	Found	Guaranteed
3.83	0.01	0.09	[1]0.16	4.09	3.28	1.06	5.91	1.25	8.22	9.00	6.97	8.00
2.54	0.02	0.10	[1]0.19	2.85	2.46	1.20	6.33	1.33	8.86	9.00	7.53	8.00
3.98	0.01	0.19	[1]0.17	4.35	4.10	0.92	5.32	1.21	7.45	8.00	6.24	7.00
0.72	1.08	0.05	0.14	1.99	1.64	6.12	3.97	0.61	10.70	11.00	10.09	10.00
0.51	0.17	0.05	0.10	0.83	0.82	7.72	2.57	0.62	10.91	11.00	10.29	10.00
0.98	0.54	0.02	0.19	1.73	1.64	4.54	3.55	0.30	8.39	9.00	8.09	8.00
2.06	1.44	0.01	0.15	3.66	4.10	6.18	2.06	0.24	8.48	9.00	8.24	8.00
1.61	1.11	0.03	0.11	2.86	3.28	7.60	2.19	0.54	10.33	11.00	9.79	10.00
1.23	0.79	0.17	0.13	2.32	2.46	5.46	2.44	0.34	8.24	9.00	7.90	8.00
2.32	0.01	0.02	0.07	2.42	3.28	6.36	2.50	0.47	9.33	9.00	8.86	8.00
....	0.01	0.29	0.46	0.76	0.82	6.20	4.04	1.60	11.84	11.00	10.24	10.00
0.49	0.53	0.14	0.43	1.59	1.65	6.88	3.90	1.63	12.41	11.00	10.78	10.00
0.82	0.75	0.29	0.44	2.30	2.47	5.86	4.55	1.00	11.41	11.00	10.41	10.00
0.96	1.24	0.40	0.33	2.93	3.29	6.00	4.60	1.25	11.85	11.00	10.60	10.00
1.32	1.07	0.63	1.09	4.11	4.11	5.48	2.67	1.42	9.57	9.00	8.15	8.00
1.49	0.84	0.10	0.41	2.84	3.29	4.24	4.39	1.13	9.76	9.00	8.63	8.00
....	0.41	0.61	0.42	1.44	1.23	5.46	4.46	1.08	11.00	11.00	9.92	10.00
1.54	1.62	0.37	0.77	4.30	4.11	6.60	4.04	1.13	11.77	11.00	10.64	10.00
....	0.04	0.30	[3]0.56	0.90	0.82	4.30	4.13	0.92	9.35	9.00	8.43	8.00
0.52	0.10	0.42	0.47	1.51	1.65	7.34	4.93	1.17	13.44	13.00	12.27	12.00
0.71	0.01	0.27	0.59	1.58	1.65	5.88	5.08	1.51	12.47	11.00	10.96	10.00
0.83	1.04	0.38	0.75	3.00	3.29	6.78	3.77	1.08	11.63	11.00	10.55	10.00
1.53	0.65	0.51	0.70	3.39	3.29	6.24	3.91	1.49	11.64	11.00	10.15	10.00
1.15	0.27	0.34	0.46	2.22	2.47	6.70	3.22	2.25	12.17	11.00	9.92	10.00
1.50	0.69	0.49	0.65	3.33	3.29	6.94	3.16	1.56	11.66	11.00	10.10	10.00
0.21	0.12	0.66	0.64	1.63	1.65	5.36	4.26	2.25	11.87	11.00	9.62	10.00
0.94	0.42	0.43	0.62	2.41	2.47	7.76	2.51	1.88	12.15	11.00	10.27	10.00
....	0.10	0.91	0.59	1.60	1.65	5.12	4.53	2.26	11.91	11.00	9.65	10.00
1.61	0.43	0.45	0.65	3.14	3.29	7.16	3.00	2.09	12.25	11.00	10.16	10.00
3.42	1.52	0.25	0.42	5.61	5.76	4.80	1.62	1.88	8.30	7.00	6.42	6.00
1.60	0.61	0.30	0.64	3.15	3.30	8.10	2.26	1.26	11.62	11.00	10.36	10.00
0.33	0.11	0.44	0.60	1.48	1.65	5.84	4.35	1.84	12.03	11.00	10.19	10.00
0.48	1.68	0.23	0.97	3.36	2.47	5.88	3.27	2.33	11.48	11.00	9.15	10.00
1.53	0.87	0.16	0.48	3.04	3.29	5.94	4.58	1.20	11.72	11.00	10.52	10.00
0.36	0.53	0.19	0.41	1.49	1.65	6.46	3.85	1.64	11.95	11.00	10.31	10.00
1.00	0.25	0.53	[2]0.63	2.41	2.47	7.16	2.61	2.33	12.10	11.00	9.77	10.00

[1] Insoluble organic nitrogen of inferior quality. Excess of total nitrogen offsets the amount of inferior quality.

[2] Insoluble organic nitrogen of inferior quality.

[3] Insoluble organic nitrogen of inferior quality. Excess of total nitrogen partially offsets amount of inferior quality.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen and Phosphoric Acid

Station Number	Manufacturer and Brand	Where Sampled
	American Agricultural Chemical Co., New York City—(Continued)	
18936	Williams & Clark's Spec. Potato and Root Fertilizer	Milltown
18890	Williams & Clark's Sterling Mixture	Dayton
180138	Williams & Clark's Mammoth Crop Producer	Dundee Lake
	American Fertilizing Co., Baltimore, Md.	
18260	American Fish Special	Elmer
18419	American Eagle Potato and Truck Grower	Westville
18889	American Special Fish Guano	Prospect Plains
	Armour Fertilizer Works, Baltimore, Md., and Chrome, N. J.	
18001	Armour's Potato and Truck Fertilizer	Skillman
18002	Armour's Corn, Grain and Grass Fertilizer	Skillman
18004	Armour's Top Dressing for Grass Sods	Skillman
18223	Armour's 5-10 Fertilizer	Chews Landing
18797	Armour's 4-10 Fertilizer	Medford
18798	Armour's 3-10 Fertilizer	Medford
18402	Armour's 2-10 Fertilizer	Salem
18691	Blood and Meat, 1918	Tuckahoe
18693	Sweet Potato, 1918	Tuckahoe
18846	Armour's 1-10 Fertilizer	Hightstown
	J. H. Baird & Son, Marlboro, N. J.	
18096	J. H. Baird's 4½-10½-0	Marlboro
	Baltimore Pulverizing Co., Baltimore, Md.	
18052	Practical Fertilizer	Mt. Holly
	Baugh & Son's Co., Philadelphia, Pa.	
18039	Baugh's H. G. Ammoniated Animal Base	Moorestown
18035	Baugh's The Old Stand-by Dissolved Animal Base	Mt. Holly
18923	Baugh's Wheat Fertilizer for Wheat and Grass	Hightstown
18628	Baugh's Corn and Oats Fertilizer	Moorestown
18152	Baugh's Truckers' Favorite	Palmyra
18140	Baugh's Superb Potato Phosphate	Woodstown
18462	Baugh's Peninsula Grain Producer, 1918	Quinton
18464	Baugh's Half and Half Mixture	Quinton
	The Berg Co., Philadelphia, Pa.	
18230	Berg's Animal Bone and Meat	Atco
180185	Berg's Special Wheat Grower	Flemington
	Berger Bros., Eaaton, Pa.	
180153	Berger Bros.' Lehigh Superphosphate, 1916	Asbury

COMMERCIAL FERTILIZERS

Furnishing Nitrogen and Phosphoric Acid

Manufacturer and Brand						Phosphoric Acid						
											Available	
As Nitrates	As Ammonia Salts	As Soluble Organic Matter	As Insoluble Organic Matter	Total Found	Total Guaranteed	Soluble in Water	Soluble in Ammonium Citrate	Insoluble	Total Found	Total Guaranteed	Found	Guaranteed
1.36	0.68	0.53	0.56	3.13	3.29	6.46	3.35	2.10	11.91	11.00	9.81	10.00
0.63	0.22	0.34	0.53	1.72	1.65	7.26	3.15	2.61	13.02	11.00	10.41	10.00
1.31	0.34	0.25	0.55	2.45	2.47	7.16	2.59	2.53	12.28	11.00	9.75	10.00
Tr.	0.05	0.67	[1]0.96	1.68	1.65	6.56	3.65	2.64	12.85	12.00	10.21	11.00
2.53	0.04	0.27	0.57	3.41	3.29	6.94	1.97	1.01	9.92	9.00	8.91	8.00
....	0.01	0.24	0.50	0.75	0.82	6.10	4.83	2.22	13.15	11.00	10.93	10.00
1.40	1.38	0.20	1.31	4.29	4.11	10.08	1.15	2.22	13.45	10.50	11.23	10.00
1.89	0.03	0.02	0.55	2.49	2.47	13.00	0.76	0.78	14.54	14.50	13.76	14.00
6.34	0.05	0.08	0.28	6.75	6.56	6.00	1.53	2.87	10.40	6.50	7.53	6.00
0.83	1.28	0.32	1.53	3.96	4.11	9.08	1.17	0.93	11.18	10.50	10.25	10.00
1.74	0.04	0.28	1.12	3.18	3.29	8.90	1.08	0.69	10.67	10.50	9.98	10.00
0.74	0.46	0.08	1.00	2.28	2.47	7.66	1.77	0.75	10.18	10.50	9.43	10.00
0.21	0.21	0.39	1.07	1.88	1.65	8.96	1.65	1.00	11.61	10.50	10.61	10.00
Tr.	0.42	0.24	0.93	1.59	1.65	9.30	2.11	0.87	12.28	10.50	11.41	10.00
Tr.	0.26	0.39	0.63	1.28	1.23	4.76	5.09	3.70	13.55	9.50	9.85	9.00
Tr.	0.03	0.45	0.36	0.84	0.82	7.60	0.42	2.00	10.92	10.50	8.92	10.00
1.89	0.05	0.50	1.29	3.73	3.70	8.42	2.69	2.15	13.26	12.75	11.11	10.50
0.81	0.01	0.02	0.22	1.06	0.82	0.70	5.76	0.56	7.02	8.00	6.46	8.00
1.21	1.23	0.14	0.65	3.23	3.30	8.46	2.76	2.22	13.44	10.00	11.22	10.00
0.53	0.60	0.14	0.38	1.65	1.65	9.92	3.02	0.99	13.93	12.00	12.94	12.00
0.44	0.38	0.27	0.58	1.67	1.65	8.06	2.90	1.31	12.27	10.00	10.96	10.00
0.39	0.12	0.57	[3]0.44	1.52	1.65	7.94	1.68	1.51	11.13	10.00	9.62	10.00
Tr.	0.13	1.62	0.73	2.48	2.47	5.42	4.41	3.65	13.48	10.00	9.83	10.00
1.48	2.03	0.34	0.35	4.20	4.12	9.20	1.46	0.73	11.39	10.00	10.66	10.00
....	0.09	0.60	[2]0.43	1.12	0.82	7.30	2.57	1.18	11.05	9.00	9.87	9.00
....	0.16	0.58	0.65	1.39	1.23	5.62	6.11	9.22	20.95	19.00	11.73	12.00
1.40	0.06	0.45	1.46	3.37	3.30	1.92	9.12	6.90	17.94	17.00	11.04	.....
....	0.03	0.49	1.37	1.89	1.65	4.92	3.54	4.23	12.69	11.00	8.46	8.00
0.62	0.18	0.21	0.45	1.46	1.65	6.92	3.81	1.99	12.72	11.00	10.73	10.00

[1] Insoluble organic nitrogen of inferior quality. Excess of total nitrogen partially offsets the amount of inferior quality.

[2] Insoluble organic nitrogen of infeiior quality. Excess of total nitrogen offsets the amount of inferior quality.

[3] Insoluble organic nitrogen of inferior quality.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen and Phosphoric Acid

Station Number	Manufacturer and Brand	Where Sampled
	Bowker Fertilizer Co., New York City.	
18316	Bowker's Superphosphate with Ammonia 1%	Bridgeton
18728	Bowker's Superphosphate with Ammonia 2%	Red Bank
18749	Bowker's Superphosphate with Ammonia 3%	Matawan
18811	Bowker's Superphosphate with Ammonia 4%	Medford
18285	Bowker's Superphosphate with Ammonia 5%	Elm
	Burlington County Farmers Exchange, Mt. Holly, N. J.	
18070	Circle A Brand 4-10-0	Mt. Holly
18192	*Circle A Brand 4-10-0	Collingswood
18191	Circle A Brand 2-10-0	Collingswood
	Chamberlin & Barclay, Cranbury, N. J.	
18895	C & B 1918 Top Dressing	Cranbury
	Coe-Mortimer Co., New York City.	
18153	E. Frank Coe's Prolific Crop Producer, 1916	Palmyra
18199	E. Frank Coe's Original Ammoniated Dissolved Phosphate, 1916	Riverside
18200	E. Frank Coe's Gardeners' and Truckers' Special, 1916	Riverside
180006	E. Frank Coe's XXV Ammoniated Phosphate, 1916	Skillman
18740	E. Frank Coe's H. G. Ammoniated Superphosphate, 1916	Hazlet
	J. S. Collins & Son, Inc., Moorestown, N. J.	
18049	V. C. C. Co.'s Special 3-10 Fertilizer	Moorestown
18050	3-10 Fertilizer	Moorestown
18051	4-10 Fertilizer	Moorestown
18652	Special 4-10 Fertilizer	Moorestown
	Columbia Guano Co., Baltimore, Md.	
18791	Columbia Vitalic Ammoniated Superphosphate	Lewistown
18792	Columbia Reflex Ammoniated Superphosphate	Vincentown
18842	Columbia Ammoniated Phosphate Mixture	Tennent
	Jas. G. Downward Co., Coatesville, Pa.	
18963	Pioneer Potato Phosphate	Trenton
	Alex. Forbes & Co., Newark, N. J.	
180236	Garden Fertilizer—War Brand	Newark
	Godfrey Co-operative Fert. and Chem. Co., Newark, N. J.	
180014	Godfrey's Vegetable Mixture	Three Bridges
180069	Godfrey's Corn Mixture	Pittstown
180201	Godfrey's Early Potato Mixture	Boonton
180012	Godfrey's Soluble Top Dressing for Timothy, Revised	Three Bridges
180070	Godfrey's Special Mixture	Pittstown
180072	Godfrey's Potato Mixture	Pittstown
180200	Godfrey's Grain Grower, Revised	Boonton
18838	Godfrey's Potato and Truck Mixture	Englishtown

* Duplicate sample.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen and Phosphoric Acid

Nitrogen						Phosphoric Acid						
											Available	
As Nitrates	As Ammonia Salts	As Soluble Organic Matter	As Insoluble Organic Matter	Total Found	Total Guaranteed	Soluble in Water	Soluble in Ammonium Citrate	Insoluble	Total Found	Total Guaranteed	Found	Guaranteed
Tr.	0.13	0.61	[2]0.30	1.04	0.82	7.36	3.44	1.12	11.92	11.00	10.80	10.00
0.20	0.13	0.61	0.56	1.50	1.65	4.70	5.11	2.33	12.14	11.00	9.81	10.00
0.88	0.40	0.46	0.59	2.33	2.47	7.46	2.77	1.84	12.07	11.00	10.23	10.00
1.21	1.04	0.23	0.58	3.06	3.29	6.76	3.45	1.85	12.06	11.00	10.21	10.00
1.85	1.17	0.19	0.47	3.68	4.11	5.18	3.99	0.95	10.12	9.00	9.17	8.00
1.87	1.08	0.06	0.24	3.25	3.28	6.40	3.99	1.53	11.92	11.00	10.39	10.00
3.12	0.03	0.09	0.19	3.43	3.28	5.62	4.87	0.54	11.03	11.00	10.49	10.00
1.34	0.01	0.04	0.16	1.55	1.64	5.58	6.44	2.11	14.13	11.00	12.02	10.00
7.60	.....	.....	.....	7.60	7.38	7.08	1.08	Tr.	8.16	8.00	8.16	7.00
0.81	1.49	0.40	0.49	3.19	3.29	5.70	4.87	1.28	11.85	11.00	10.57	10.00
....	0.39	0.61	0.52	1.52	1.65	5.68	4.14	1.01	10.83	11.00	9.82	10.00
....	1.76	0.82	1.17	3.75	4.11	5.96	3.18	2.22	11.36	9.00	9.14	8.00
....	0.04	0.30	0.54	0.88	0.82	4.10	5.57	2.73	12.40	11.00	9.67	10.00
1.15	0.41	0.39	[2]0.62	2.57	2.47	8.14	2.40	1.46	12.00	11.00	10.54	10.00
....	0.81	0.33	1.20	2.34	2.47	7.70	3.17	0.67	11.54	11.00	10.87	10.00
0.94	0.15	0.30	1.10	2.49	2.47	7.42	2.54	1.96	11.92	10.50	9.96	10.00
....	1.65	0.49	0.79	2.93	3.29	7.32	1.77	0.71	9.80	10.50	9.09	10.00
....	3.13	0.14	0.51	3.78	3.29	8.36	2.43	0.35	11.14	11.00	10.79	10.00
....	0.65	0.19	0.99	1.83	1.65	5.60	3.01	1.53	10.14	8.50	8.61	8.00
....	0.01	0.40	0.37	0.78	0.82	5.58	4.44	1.01	11.03	10.50	10.02	10.00
....	1.70	0.26	1.15	3.11	3.29	7.74	2.34	1.37	11.45	10.50	10.08	10.00
0.70	0.04	0.13	[1]0.44	1.31	2.46	0.24	6.47	4.51	11.22	11.00	6.71	10.00
0.63	0.05	0.19	0.52	1.39	1.65	1.04	4.01	6.26	11.31	10.00	5.05	8.00
Tr.	0.39	0.53	1.19	2.11	2.47	8.44	1.81	1.31	11.56	10.50	10.25	10.00
....	1.19	0.19	0.73	2.11	1.65	8.44	1.89	1.38	11.71	10.50	10.33	10.00
1.88	0.43	0.29	0.89	3.49	3.29	8.16	1.85	1.81	11.82	10.50	10.01	10.00
1.90	1.50	0.22	1.70	5.32	5.76	6.20	1.44	1.27	8.91	6.50	7.64	6.00
....	0.18	0.18	0.52	0.88	0.82	6.86	2.86	0.73	10.45	10.50	9.72	10.00
0.70	0.49	0.12	1.13	2.44	3.29	5.50	2.07	0.85	8.42	8.50	7.57	8.00
0.28	0.12	0.19	0.63	1.22	1.23	6.36	3.33	2.14	11.83	9.50	9.69	9.00
0.82	1.00	0.41	1.59	3.82	4.11	9.14	1.32	0.79	11.25	10.50	10.46	10.00

[1] Insoluble organic nitrogen of inferior quality.

[2] Insoluble organic nitrogen of inferior quality. Excess of total nitrogen partially offsets quantity of inferior quality.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen and Phosphoric Acid

Station Number	Manufacturer and Brand	Where Sampled
	Hendrickson & Dilatush, Robbinsville, N. J.	
18904	4-9 Potato Manure	Robbinsville
18900	Corn Manure No. 2	Robbinsville
18901	Fish Guano for Corn	Robbinsville
18903	Truckers' Manure No. 2	Robbinsville
	Heritage & Bro., Mullica Hill, N. J.	
18588	Pancoast's XX Revised	Mullica Hill
	S. M. Hess & Bro., Inc., Philadelphia, Pa.	
18006	High Grade Potato Grower	Englishtown
18843	Superior Superphosphate	Englishtown
18672	Reliable Superphosphate	Cape May
	Hill Bros., Flemington, N. J.	
180186	Hill's No. 2 Phosphate, Revised	Flemington
180187	Hill's Standard Phosphate, Revised	Flemington
	Hubbard Fertilizer Co., Baltimore, Md.	
18845	Hubbard's Excelsior Mixture 2-10-0	Englishtown
	Hutchinson & Rue, Windsor, N. J.	
18909	[1]Corn Mixture 1½-15	Windsor
	International Seed Co., Rochester, N. Y.	
18405	International General Phosphate	Salem
18406	International Crop Grower	Salem
	H. B. Kemp, Long Branch, N. J.	
18881	Kemp's Corn and Truck Fertilizer	Long Branch
18883	Kemp's Early Truck Grower	Long Branch
18884	Kemp's Potato and Vegetable Fertilizer	Long Branch
	Keystone Bone Fertilizer Co., Philadelphia, Pa.	
18290	Keystone Ammoniated Superphosphate	Elm
18291	Keystone Standard Potato Manure	Elm
18341	Keystone Special Truck and Corn Manure	Sewell
180086	Keystone Economy Grain Compound	Ringoes
180094	Keystone Special Pennsylvania Grain Mixture	Califon
	Wm. Lancaster, Philadelphia, Pa.	
18322	Grange General Manure	Bridgeton
18323	1918 Grange C Brand Potato Manure	Bridgeton
18324	1918 Grange D Brand Potato Manure	Bridgeton
18325	1918 Grange B Brand Potato Manure	Bridgeton
18764	[2]1918 Grange B Brand Potato Manure	Bridgeton

[1] According to formula submitted an error was made in calculating the guarantee for available phosphoric acid.

[2] Duplicate sample.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen and Phosphoric Acid

Nitrogen						Phosphoric Acid						
											Available	
As Nitrates	As Ammonia Salts	As Soluble Organic Matter	As Insoluble Organic Matter	Total Found	Total Guaranteed	Soluble in Water	Soluble in Ammonium Citrate	Insoluble	Total Found	Total Guaranteed	Found	Guaranteed
0.68	1.22	0.27	0.94	3.11	3.29	7.68	3.03	0.88	11.59	11.00	10.71	9.00
1.00	0.13	0.16	0.36	1.65	1.65	7.64	3.66	1.14	12.44	11.00	11.30	9.00
0.55	0.05	0.25	0.76	1.61	1.65	9.54	3.14	2.04	14.72	11.00	12.68	9.00
1.91	0.05	0.40	1.59	3.95	4.10	7.90	2.58	1.21	11.69	11.00	10.48	9.00
2.61	0.06	0.53	[1]0.83	4.03	4.12	6.56	1.95	1.00	9.51	9.00	8.51	8.00
0.28	1.94	0.61	1.12	3.95	4.11	7.06	2.69	2.03	11.78	11.00	9.75	10.00
0.67	0.04	0.26	0.70	1.67	1.65	5.88	4.83	1.72	12.43	11.00	10.71	10.00
1.00	0.68	0.19	0.37	2.24	2.47	6.90	3.75	0.99	11.64	11.00	10.65	10.00
....	0.01	0.20	0.43	0.64	0.82	6.56	3.51	2.37	12.44	11.00	10.07	10.00
0.64	0.16	0.22	0.48	1.50	1.65	6.18	4.09	1.54	11.81	11.00	10.27	10.00
....	0.10	0.47	[1]0.58	1.15	1.64	6.46	4.76	1.93	13.15	11.00	11.22	10.00
0.75	0.04	0.09	0.18	1.06	1.23	3.04	6.83	6.42	16.29	.....	9.87	15.00
0.66	0.49	0.09	0.33	1.57	1.65	5.94	4.47	1.00	11.41	11.00	10.41	10.00
0.26	0.20	0.19	0.27	0.92	0.82	6.20	4.09	0.99	11.28	11.00	10.29	10.00
0.60	0.15	0.51	0.99	2.25	2.47	7.00	2.77	1.17	10.94	10.50	9.77	10.00
0.54	1.71	0.29	1.34	3.88	4.11	8.78	1.65	0.95	11.38	10.50	10.43	10.00
1.78	0.20	0.42	0.87	3.27	3.29	8.34	2.42	1.69	12.45	10.50	10.76	10.00
....	0.11	0.66	[1]0.64	1.41	1.64	7.66	3.24	0.82	11.72	11.00	10.90	10.00
....	1.07	0.44	0.82	2.33	2.46	5.98	3.84	0.97	10.79	12.00	9.82	10.00
0.26	2.64	0.28	0.59	3.77	4.10	8.82	1.68	0.73	11.23	11.00	10.50	10.00
....	0.06	0.19	[2]0.63	0.88	0.82	5.36	3.71	0.79	9.86	10.00	9.07	9.00
....	1.08	0.55	0.63	2.26	0.82	6.60	4.56	1.01	12.17	13.00	11.16	12.00
....	0.10	0.54	0.32	0.96	0.82	3.50	8.35	2.61	14.46	13.00	11.85	12.00
0.73	1.12	0.38	0.87	3.10	3.30	8.76	1.92	0.61	11.29	11.00	10.68	10.00
0.33	1.12	0.38	0.84	2.67	2.46	7.38	2.59	1.25	11.22	11.00	9.97	10.00
....	2.42	0.55	0.87	3.84	4.12	8.76	2.12	0.82	11.70	11.00	10.88	10.00
0.34	1.14	0.13	0.70	2.31	4.12	6.30	3.45	1.47	11.22	11.00	9.75	10.00

[1] Insoluble organic nitrogen of inferior quality.

[2] Insoluble organic nitrogen of inferior quality. Excess of total nitrogen partially offsets amount of inferior quality.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen and Phosphoric Acid

Station Number	Manufacturer and Brand	Where Sampled
	Listers Agricultural Chemical Works, Newark, N. J.	
18100	Listers Superior Ammoniated Superphosphate, 1916	Freehold
18724	Listers Excelsior Guano, 1916	Lakewood
180020	Listers Crescent Ammoniated Superphosphate, 1916	Three Bridges
18822	Brakeley's Special Mixture, 1916	Freehold
18870	A. B. Special Mixture	Bordentown
180090	Listers Plant Food, 1916	Califon
180047	Listers Ground Bone and Tankage, Acidulated	Far Hills
	Locke & Black, Swedesboro, N. J.	
18231	Atkinson's No. 1 H. G. Onion and Early Truck Fertilizer without Potash	Blackwood
18524	Atkinson's No. 3 Special Sweet Potato Fertilizer without Potash	Swedesboro
18505	Atkinson's No. 5 Special Early Tomato and Asparagus Grower. without Potash	Swedesboro
18580	Atkinson's No. 3½ Sweet Potato Fertilizer without Potash	Mullica Hill
	Frederick Ludlam Co., New York City.	
180250	Ludlam's Sickle Fertilizer No. 3, 1916	Caldwell
	Mapes Formula and Peruvian Guano Co., New York City.	
18306	Mapes' 5 Per Cent Ammonia Special	Sewell
18697	Mapes' General Crop, 1916 Brand	Germania
180217	Mapes' Top Dresser, Half Strength, 1916	Sussex
	Martin Fertilizer Co., Philadelphia, Pa.	
18249	Martin's Pure Dissolved Animal Matter	Blue Anchor
18250	Martin's Ammoniated Phosphate 4-8	Blue Anchor
18251	Martin's Ammoniated Phosphate 3-8	Blue Anchor
18379	Martin's Crop Producer	Bridegton
18418	Martin's Ammoniated Phosphate 2-8	Swedesboro
	Monmouth County Farmers Exchange, Freehold, N. J.	
18032	Triangle Brand 5-10-0	Englishtown
18059	Triangle Brand 4-10-0	Mt. Holly
18817	Triangle Brand 8-6-0	Freeehold
18823	Triangle Brand 2-11-0	Freeehold
18826	Triangle Brand 1-12-0	Marlboro
	Jos. R. Moore, Swedesboro, N. J.	
18501	J. R. Moore's 2-10-0 Sweet Potato Manure	Swedesboro
18515	J. R. Moore's 4-10-0 Potato Manure	Swedesboro
	Nassau Fertilizer Co., New York City.	
18950	Common Sense Fertilizer, 1916	Bound Brook
180095	Old Hickory, 1916	New Germantown
180057	Buckwheat Special	White House Sta.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen and Phosphoric Acid

Manufacturer and Brand						Phosphoric Acid						
											Available	
As Nitrates	As Ammonia Salts	As Soluble Organic Matter	As Insoluble Organic Matter	Total Found	Total Guaranteed	Soluble in Water	Soluble in Ammonium Citrate	Insoluble	Total Found	Total Guaranteed	Found	Guaranteed
1.57	0.71	0.38	0.46	3.12	3.29	8.14	2.18	1.40	11.72	11.00	10.32	10.00
1.10	0.14	0.62	0.79	2.65	2.47	7.82	2.75	2.68	13.25	11.00	10.57	10.00
0.70	0.32	0.13	0.56	1.71	1.65	7.30	3.61	0.95	11.86	11.00	10.91	10.00
....	1.30	0.44	2.12	3.86	4.11	5.02	1.94	3.19	10.15	9.00	6.96	8.00
1.49	1.36	0.03	0.98	3.86	4.53	7.28	2.71	1.33	11.32	11.00	9.99	10.00
....	0.01	0.18	[1]0.65	0.84	0.82	5.40	4.95	1.62	11.97	11.00	10.35	10.00
....	0.32	0.54	1.91	2.77	2.67	2.52	3.97	8.05	14.54	12.00	6.49	.....
1.77	0.08	0.44	1.11	3.40	3.70	7.98	0.59	1.32	9.89	9.00	8.57	8.00
....	0.09	0.64	0.72	1.45	1.65	8.20	2.90	2.03	13.13	12.00	11.10	11.00
2.11	0.06	1.10	[1]1.11	4.38	4.32	6.62	1.93	1.22	9.77	9.00	8.55	8.00
0.92	0.03	0.25	0.30	1.50	1.65	5.60	2.26	1.29	9.15	9.00	7.86	8.00
1.12	0.23	0.45	0.53	2.33	2.47	7.22	2.67	2.97	12.86	11.00	9.89	10.00
4.00	0.01	0.01	[2]0.41	4.43	4.12	2.80	5.35	3.57	11.72	10.00	8.15	8.00
1.27	0.01	0.18	[2]0.37	1.83	1.65	2.82	4.65	4.04	11.51	10.00	7.47	8.00
4.70	.....	0.31	0.29	5.30	4.94	1.08	1.49	2.28	4.85	4.00	2.57	2.50
....	0.33	0.43	0.94	1.70	1.65	8.72	3.08	1.90	13.70	12.00	11.80	....
1.40	1.30	0.12	[3]0.34	3.16	3.30	7.10	2.49	1.43	11.02	8.00	9.59	8.00
....	0.82	0.42	[3]0.57	1.81	2.47	6.78	3.47	1.74	11.99	8.00	10.25	8.00
0.21	0.05	0.17	[3]0.36	0.79	1.03	7.54	3.85	2.33	13.72	11.00	11.39	10.00
0.60	0.06	0.11	[3]0.77	1.54	1.65	6.10	2.23	2.69	11.02	9.00	8.33	8.00
1.74	1.00	0.06	1.21	4.01	4.11	7.10	2.94	2.32	12.36	11.00	10.04	10.00
1.51	0.79	0.23	0.92	3.45	3.29	8.06	3.13	1.70	12.89	11.00	11.19	10.00
5.80	0.06	0.16	0.68	6.70	6.58	6.64	1.20	1.67	9.51	7.00	7.84	6.00
0.49	0.08	0.34	0.80	1.71	1.64	8.58	2.52	3.49	14.59	12.00	11.10	11.00
....	0.04	0.32	0.66	1.02	0.82	5.22	5.93	5.30	16.45	13.00	11.15	12.00
1.19	0.02	0.16	0.15	1.52	1.65	8.20	2.30	0.54	11.04	11.00	10.50	10.00
3.17	0.01	0.02	0.16	3.36	3.29	8.42	2.34	1.01	11.77	11.00	10.76	10.00
0.68	0.33	0.10	0.52	1.63	1.65	7.68	3.31	0.74	11.73	11.00	10.99	10.00
....	0.06	0.08	[3]0.62	0.76	0.82	5.66	4.27	1.53	11.46	11.00	9.93	10.00
....	0.19	0.29	0.45	0.93	0.82	5.64	3.04	0.87	9.55	9.00	8.68	8.00

[1] Insoluble organic nitrogen of inferior quality. Excess of total nitrogen partially offsets amount of inferior quality.

[2] Insoluble organic nitrogen of inferior quality. Excess of total nitrogen offsets amount of inferior quality.

[3] Insoluble organic nitrogen of inferior quality.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen and Phosphoric Acid

Station Number	Manufacturer and Brand	Where Sampled
	Albert Nelson, Allentown, N. J.	
18913	Nelson's Special G & G Guano	Nelsonville
18915	Nelson's Special Potato Grower	Nelsonville
18916	Nelson's Superior Potato Grower	Nelsonville
18917	Nelson's R & W Guano	Nelsonville
	Patapsco Guano Co., Baltimore, Md.	
18766	Patapsco Truckers' Delight	Red Bank
	Philadelphia Guano Works, Philadelphia, Pa.	
180061	1918 Corn and Vegetable Manure	Annandale
18948	1918 Grain Superphosphate	Bound Brook
	Rasin Monumental Co., Baltimore, Md.	
18062	Rasin's Potato and Vegetable Ammoniated Superphosphate	Edgewater Park
18061	Rasin's Special Fish Guano	Edgewater Park
18815	Rasin's Potato and Truck Compound	Freehold
18448	Rasin's Empire Superphosphate	Bridgeton
18908	Rasin's Special Crop Preparation	Windsor
18869	Rasin's Special Fish and Bone Guano	Burlington
180043	Rasin's Special Fish Mixture	Neshanic
	Reading Bone Fertilizer Co., Reading, Pa.	
18594	High Grade Truck Food	Pedricktown
	Reading Chemical Co., Reading, Pa.	
180155	Pennant Winner	Blairstown
180156	Reading Soil Builder	Blairstown
180157	Reading Royal Fish Guano	Blairstown
	F. S. Royster Guano Co., Baltimore, Md.	
18030	Royster's Curfew Ammoniated Superphosphate	Hightstown
18836	*Royster's Curfew Ammoniated Superphosphate	Tennent
18563	Royster's Flamingo Ammoniated Superphosphate	Swedesboro
18565	Royster's Abundant Ammoniated Superphosphate	Swedesboro
18617	Royster's Penguin Ammoniated Superphosphate	Vineland
18616	Royster's Gazelle Ammoniated Superphosphate	Vineland
18739	Royster's Landmark Ammoniated Superphosphate	Keansburg
18937	Royster's Royal Blue Ammoniated Superphosphate	Millstone
18771	Royster's C. B. Fish Mixture	Red Bank
18828	Royster's Innovation Ammoniated Phosphate	Tennent
	Ruckman Bros., New Brunswick, N. J.	
18930	5 and 8 Fertilizer	New Brunswick
18931	Special Grain Grower	New Brunswick
	Schanck, Hutchinson & Field, Hightstown, N. J.	
18856	S. H. & F. Corn Mixture	Hightstown
18857	S. H. & F. Potato and Vegetable Compound	Hightstown

* Duplicate sample.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen and Phosphoric Acid

Nitrogen: As Nitrates	Nitrogen: As Ammonia Salts	Nitrogen: As Soluble Organic Matter	Nitrogen: As Insoluble Organic Matter	Nitrogen: Total Found	Nitrogen: Total Guaranteed	Phosphoric Acid: Soluble in Water	Phosphoric Acid: Soluble in Ammonium Citrate	Phosphoric Acid: Insoluble	Phosphoric Acid: Total Found	Phosphoric Acid: Total Guaranteed	Available: Found	Available: Guaranteed
....	0.69	0.34	0.52	1.55	1.65	5.72	3.59	2.62	11.93	11.00	9.31	10.00
2.34	0.04	0.24	0.61	3.23	3.29	6.28	1.65	1.02	8.95	9.00	7.93	8.00
2.54	0.06	0.63	1.00	4.23	4.12	6.34	1.62	0.93	8.89	9.00	7.96	8.00
....	0.05	0.39	0.45	0.89	0.82	4.24	4.21	3.01	11.46	10.00	8.49	9.00
1.12	0.40	0.31	0.49	2.32	2.47	7.20	2.88	1.58	11.66	11.00	10.08	10.00
....	0.43	0.39	[1]0.79	1.61	1.64	6.30	3.18	0.64	10.12	11.00	9.48	10.00
....	0.47	0.38	0.35	1.20	0.82	4.12	7.75	1.29	13.16	13.00	11.87	12.00
....	2.22	0.30	0.81	3.33	3.29	6.12	1.85	0.54	8.51	9.00	7.97	8.00
....	0.05	0.59	0.92	1.56	1.65	5.98	4.98	2.37	13.33	12.00	10.96	11.00
2.59	0.05	0.05	0.54	3.23	3.29	7.74	2.25	1.18	11.17	11.00	9.99	10.00
1.60	0.05	0.30	[1]0.41	2.36	2.47	7.16	2.55	1.37	11.08	11.00	9.71	10.00
....	0.67	0.36	0.54	1.57	1.65	7.52	3.90	1.87	13.29	11.00	11.42	10.00
....	0.08	0.77	0.74	1.59	1.65	5.94	4.80	3.29	14.03	12.00	10.74	11.00
....	0.03	0.45	0.38	0.86	0.82	7.76	2.82	1.84	12.42	11.00	10.58	10.00
....	2.06	0.78	0.44	3.28	3.29	9.44	2.85	1.92	14.21	13.00	12.29	12.00
2.13	.....	0.16	0.13	2.42	2.46	6.56	4.38	0.65	11.59	.....	10.94	10.00
0.87	.....	0.36	[1]0.19	1.42	1.64	4.50	5.88	1.34	11.72	.....	10.38	10.00
0.76	0.02	0.11	[2]0.18	1.07	1.03	6.94	5.15	1.59	13.68	.....	12.09	12.00
....	1.49	0.53	0.78	2.80	3.29	5.50	2.42	1.33	9.25	8.50	7.92	8.00
....	1.58	0.43	1.16	3.17	3.29	4.82	3.38	1.31	9.51	8.50	8.20	8.00
....	1.11	0.51	0.46	2.08	2.06	9.64	2.52	1.16	13.32	12.50	12.16	12.00
....	2.35	0.27	1.26	3.88	4.11	8.62	1.49	0.82	10.93	10.50	10.11	10.00
....	0.82	0.34	[2]0.57	1.73	1.65	6.46	3.37	1.65	11.48	10.50	9.83	10.00
....	0.97	0.83	0.71	2.51	2.47	6.56	2.83	1.54	10.93	10.50	9.39	10.00
....	1.56	0.41	1.36	3.33	3.29	7.64	2.31	1.49	11.44	10.50	9.95	10.00
....	0.06	0.50	[2]0.40	0.96	0.82	5.64	4.26	1.65	11.55	10.50	9.90	10.00
....	0.81	0.15	0.62	1.58	1.65	5.14	2.95	1.10	9.19	8.50	8.09	8.00
....	1.11	0.30	1.07	2.48	2.47	5.60	2.49	1.54	9.63	8.50	8.09	8.00
2.34	0.17	0.24	1.36	4.11	4.11	6.16	3.01	2.78	11.95	10.00	9.17	8.00
0.88	0.38	0.23	0.80	2.29	2.47	6.82	3.74	2.44	13.00	11.00	10.56	10.00
....	0.98	0.21	0.29	1.48	1.65	6.56	2.23	0.50	9.29	9.00	8.79	8.00
2.60	0.02	0.18	0.33	3.13	3.29	8.60	1.63	0.98	11.21	11.00	10.23	10.00

[1] Insoluble organic nitrogen of inferior quality.

[2] Insoluble organic nitrogen of inferior quality. Excess of total nitrogen partially offsets amount of inferior quality.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen and Phosphoric Acid

Station Number	Manufacturer and Brand	Where Sampled
	Scott Fertilizer Co., Elkton, Md.	
18292	W. R. Hackett's No. 2 Special Corn and Tomato	Quinton
18293	W. R. Hackett's No. 3 Special Tomato Manure	Quinton
180074	Scott's Ammoniated Base	Frenchtown
180075	Scott's Crop Grower	Frenchtown
	M. L. Shoemaker & Co., Philadelphia, Pa.	
18042	Swift-Sure Phosphate for Tobacco and General Use	Moorestown
18539	Swift-Sure Guano for Tomatoes, Truck and Corn	Vineland
	Harry L. Sickel, Woodbury, N. J.	
18497	C. Sickel's 4-10 for White Potatoes	Vineland
18498	A. Sickel's High Grade White Potato Fertilizer	Vineland
	South Jersey Farmers Exchange, Woodstown, N. J.	
18547	A Exchange H. G. Potato and Truck Fertilizer	Daretown
18371	C Exchange General Use Fertilizer	Mickleton
18443	|B| Exchange High Grade Potato Fertilizer	Bridegton
18386	|C| Exchange General Use Fertilizer	Bridegton
18584	|F| Exchange Special Asparagus Fertilizer	Mullica Hill
18531	:C: Exchange General Use Fertilizer	Woodstown
18530	:F: Exchange Special Asparagus Fertilizer	Woodstown
18582	A Exchange X H. G. Potato and Truck Fertilizer	Mullica Hill
18585	C Exchange X General Use Fertilizer	Mullica Hill
18528	Special Early Tomato Fertilizer	Woodstown
	Standard Guano Co., Baltimore, Md.	
18760	3-10	Bridgeton
18761	4-10	Bridgeton
18763	5-10	Bridgeton
	Swift & Co., Baltimore, Md.	
18509	Swift's General Crop Fertilizer	Swedesboro
18553	Swift's Jersey White Potato Grower	Swedesboro
18558	Swift's Jersey Sweet Potato Fertilizer	Swedesboro
18560	Swift's Clay Soil Special	Swedesboro
18561	Swift's Truck and Potato Fertilizer	Swedesboro
18832	Swift's Special Baltimore Formula	Tennent

COMMERCIAL FERTILIZERS

Furnishing Nitrogen and Phosphoric Acid

Nitrogen						Phosphoric Acid						
											Available	
As Nitrates	As Ammonia Salts	As Soluble Organic Matter	As Insoluble Organic Matter	Total Found	Total Guaranteed	Soluble in Water	Soluble in Ammonium Citrate	Insoluble	Total Found	Total Guaranteed	Found	Guaranteed
....	0.08	0.72	1.71	2.51	2.50	7.40	3.66	7.38	18.44	16.00	11.06	16.00
....	0.10	1.09	2.28	3.47	3.69	7.18	2.77	3.66	13.61	15.00	9.95	13.00
....	0.03	0.67	0.83	1.53	1.65	9.80	2.91	1.56	14.27	14.00	12.71	12.00
....	0.06	0.61	[1]0.68	1.35	1.65	6.90	2.25	1.00	10.15	10.00	9.15	8.00
0.69	0.01	0.87	1.51	3.08	3.29	7.80	3.75	2.96	14.51	12.00	11.55	9.00
0.57	0.02	0.57	0.79	1.95	1.65	4.54	4.72	4.68	13.94	10.00	9.26	8.00
0.76	1.50	0.32	0.44	3.02	3.30	9.10	1.31	1.01	11.42	10.00	10.41	10.00
0.82	0.71	0.31	[1]0.54	2.38	2.47	7.76	2.19	1.58	11.53	10.00	9.95	10.00
....	2.27	0.28	1.20	3.75	4.11	8.72	2.01	1.05	11.78	11.00	10.73	10.00
....	0.81	0.43	1.20	2.44	2.46	7.60	2.63	1.24	11.47	11.00	10.23	10.00
....	2.03	0.18	1.22	3.43	3.29	7.82	1.94	1.10	10.86	11.00	9.76	10.00
....	0.68	0.08	2.04	2.80	2.47	7.64	2.10	1.10	10.84	11.00	9.74	10.00
....	1.40	0.36	2.91	4.67	4.93	6.50	2.18	1.27	9.95	9.00	8.68	8.00
0.90	0.88	0.11	0.74	2.63	2.45	7.44	2.75	1.58	11.77	11.00	10.19	10.00
1.64	1.87	0.11	1.13	4.75	4.90	8.00	2.24	0.89	11.13	9.00	10.24	8.00
2.33	0.01	0.19	1.12	3.65	4.12	9.82	1.22	0.51	11.55	11.00	11.04	10.00
1.44	0.07	0.03	0.75	2.29	2.46	9.18	2.17	0.90	12.25	11.00	11.35	10.00
2.61	0.22	0.11	2.29	5.23	5.33	6.32	2.24	2.20	10.76	9.00	8.56	8.00
1.44	0.01	0.28	0.61	2.34	2.47	8.88	2.28	0.66	11.82	....	11.16	10.00
Tr.	1.32	0.33	0.65	2.30	3.29	9.92	1.58	0.60	12.10	.....	11.50	10.00
2.76	0.02	0.14	[1]0.72	3.64	4.12	9.24	1.62	0.83	11.69	.....	10.86	10.00
0.23	0.83	.....	1.47	2.53	2.47	5.58	3.20	1.57	10.35	9.00	8.78	9.00
0.20	1.35	0.25	1.53	3.33	3.29	5.34	2.38	1.09	8.81	8.00	7.72	8.00
....	0.87	0.04	0.50	1.41	1.65	5.02	2.80	0.63	8.45	8.00	7.82	8.00
0.30	1.17	0.04	[2]1.09	2.60	1.65	6.30	2.95	1.35	10.60	12.00	9.25	12.00
0.25	1.54	0.10	1.26	3.15	3.29	6.00	3.00	1.10	10.10	8.00	9.00	8.00
0.26	1.85	0.06	1.16	3.33	3.29	6.68	2.80	1.50	10.98	10.00	9.48	10.00

[1] Insoluble organic nitrogen of inferior quality.

[2] Insoluble organic nitrogen of inferior quality. Excess of total nitrogen offsets amount of inferior quality.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen and Phosphoric Acid

Station Number	Manufacturer and Brand	Where Sampled
	Swift & Co., Kearny, N. J.	
18069	Holly Harrison Formula Fertilizer	Mt. Holly
18861	Swift's Special Crop Grower	Jamesburg
18862	Swift's Special Pride of Jersey Fertilizer	Jamesburg
18097	Swift's Long Island Favorite Fertilizer	Marlboro
180207	*Swift's Long Island Favorite Fertilizer	Greystone Park
18827	Swift's Special Harrison Formula	Marlboro
18169	Swift's Truck and Potato Fertilizer	Fish House
180205	Swift's Special Fertilizer for Grass	Greystone Park
180206	Swift's Special Fertilizer for Corn	Greystone Park
18166	Swift's Special Top Dressing	Fish House
18171	Swift's Special Long Island Fertilizer	Fish House
18789	Holly Special Harrison Formula	Pennington
18794	Swift Pure Truck and Potato Fertilizer	Mt. Holly
180048	Swift's Wheat and Rye Grower	Far Hills
18978	Swift's Diamond C Grain Fertilizer	Martinsville
180038	Swift's Three, Ten, Naught	Gladstone
	I. P. Thomas & Son Co., Philadelphia, Pa.	
18427	Long Island Special 4-10-0	New Lisbon
18654	Special Mixture No. 3 (Formula stated)	Moorestown
18653	Special Mixture No. 4 (Formula stated)	Moorestown
18326	Fish Guano	Bridgeton
18337	7 Per Cent Guano	Westville
18780	Dugan's 5-10-0	Moorestown
180063	Thomas' Triumph Manure	Barbertown
180066	Thomas' Wheat and Corn Guano	Barbertown
180068	Raw and Acidulated Bone	Barbertown
	Trenton Bone Fertilizer Co., Trenton, N. J.	
18134	Borden's Fish Mixture	Beverly
18942	Sweet Potato and Corn	Middlebush
18971	Corn Special	Pennington
18944	Oats Mixture	Middlebush
18968	Special Mixture No. 108	Pennington
18969	4-8 Potato	Pennington
18972	Bone and Tankage	Pennington
18998	Special Grain	Hopewell

* Duplicate sample.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen and Phosphoric Acid

Nitrogen						Phosphoric Acid						
											Available	
As Nitrates	As Ammonia Salts	As Soluble Organic Matter	As Insoluble Organic Matter	Total Found	Total Guaranteed	Soluble in Water	Soluble in Ammonium Citrate	Insoluble	Total Found	Total Guaranteed	Found	Guaranteed
0.35	1.74	0.17	0.75	3.01	3.29	6.96	3.33	1.79	12.08	10.00	10.29	10.00
0.13	0.76	0.16	0.31	1.36	1.65	6.50	3.60	1.48	11.58	10.00	10.10	10.00
0.15	2.41	0.33	0.93	3.82	4.11	6.26	2.08	1.20	9.54	8.00	8.34	8.00
....	2.21	0.35	0.92	3.48	4.11	7.12	3.02	1.91	12.05	10.00	10.14	10.00
....	2.27	0.43	0.96	3.66	4.11	7.28	2.78	2.20	12.26	10.00	10.06	10.00
0.15	1.94	0.12	0.96	3.17	3.29	7.98	1.87	0.99	10.84	10.00	9.85	10.00
0.46	1.96	0.11	0.87	3.40	3.29	5.42	2.60	1.45	9.47	8.00	8.02	8.00
4.56	0.06	1.00	1.02	6.64	6.55	3.40	2.12	1.59	7.11	6.00	5.52	6.00
0.41	1.61	0.20	0.70	2.92	2.75	8.54	2.86	1.96	13.36	12.00	11.40	12.00
2.62	2.06	1.04	1.42	7.14	8.23	4.46	1.33	1.94	7.73	5.00	5.79	5.00
Tr.	2.91	0.60	1.25	4.76	4.94	6.04	2.27	2.00	10.31	8.00	8.31	8.00
1.39	0.39	0.57	0.79	3.14	3.29	8.22	2.17	1.88	12.27	10.00	10.39	10.00
2.02	0.20	0.21	0.79	3.22	3.29	5.36	2.74	1.60	9.70	8.00	8.10	8.00
Tr.	0.29	0.22	1.03	1.54	1.65	2.78	3.79	2.24	8.81	8.00	6.57	8.00
0.54	0.03	0.13	0.20	0.90	0.82	6.32	2.55	0.58	9.45	8.00	8.87	8.00
0.56	0.06	0.28	1.19	2.09	2.47	4.28	4.06	2.68	11.02	10.00	8.34	10.00
1.21	1.20	0.18	0.48	3.07	3.25	6.14	3.61	1.22	10.97	10.50	9.75	10.00
1.32	0.17	0.42	1.29	3.20	....	8.36	1.91	1.42	11.69	.....	10.27	.....
....	0.04	0.47	0.78	1.29	.....	4.16	7.73	6.67	18.56	.....	11.89	.....
0.90	2.26	0.17	0.62	3.95	4.10	9.00	2.21	1.26	12.47	10.50	11.21	10.00
1.84	2.49	0.34	0.83	5.50	5.75	8.20	1.15	0.44	9.79	8.50	9.35	8.00
0.70	1.52	0.23	1.46	3.91	4.10	9.48	1.83	1.26	12.57	.....	11.31	10.00
....	0.48	0.16	0.40	1.04	0.82	6.60	3.86	2.25	12.71	10.50	10.46	10.00
....	0.85	0.20	0.49	1.54	1.65	6.20	3.41	1.72	11.33	10.50	9.61	10.00
....	0.04	0.61	1.86	2.51	1.65	1.20	12.26	9.35	22.81	17.00	13.46	.....
1.83	0.15	0.72	1.39	4.09	4.10	3.72	2.42	0.95	7.09	6.00	6.14	5.00
0.55	0.05	0.33	0.64	1.57	1.64	8.42	3.31	1.29	13.02	11.00	11.73	10.00
1.50	0.07	0.47	0.33	2.37	2.47	9.08	2.68	1.61	13.37	12.00	11.76	11.00
0.21	0.03	0.19	[1]0.39	0.82	0.82	6.88	4.30	0.63	11.81	11.00	11.18	10.00
1.21	.....	0.34	[1]0.40	1.95	2.05	4.56	5.86	1.50	11.92	11.00	10.42	10.00
1.58	0.05	0.50	[1]0.92	3.05	3.28	5.90	3.62	1.33	10.85	9.00	9.52	8.00
0.26	0.13	0.83	1.23	2.45	2.06	2.78	6.61	5.70	15.09	9.00	9.39	8.00
0.50	0.03	0.31	0.49	1.33	1.64	6.86	5.15	1.57	13.58	10.00	12.01	9.00

[1] Insoluble organic nitrogen of inferior quality.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen and Phosphoric Acid

Station Number	Manufacturer and Brand	Where Sampled
	F. W. Tunnell & Co., Inc., Philadelphia, Pa.	
18064	1918 No. 2 Potato and Truck Manure	Edgewater Park
18075	1918 No. 1 Potato and Truck Manure	Beverly
18128	Long Island Trucker	Beverly
18236	1918 General Crop Grower	Blackwood
18235	1918 Fish and Tankage	Blackwood
18270	1918 Lightning Guano	Westville
18299	1918 Fish Manure	Glassboro
180166	1918 Corn Mixture	Morristown
18272	Grain Manure	Westville
18468	1918 Raw and Acidulated Animal Compound	Bridgeton
18487	1918 X-2 Sweet Potato Manure	Swedesboro
18543	1918 Potato and Vegetable Manure	Bridgeton
18647	High Grade Fish and Truck Guano	Moorestown
180008	Wheat Grower	Skillman
180028	1917 Potato and Vegetable Manure	Bernardsville
	J. E. Tygert & Co., Philadelphia, Pa.	
18068	Tygert's Great Advancer Phosphate, 1916	Mt. Holly
18865	Tygert's Ammoniated Fertilizer—A	Burlington
18047	Tygert's Ammoniated Fertilizer—AA	Mt. Holly
18048	Tygert's Ammoniated Fertilizer—AAA	Mt. Holly
	Virginia-Carolina Chemical Co., New York City.	
18519	V. C. C. Co.'s Truckers' Mixture without Potash	Swedesboro
18772	V. C. C. Co.'s 20th Century Potato Manure without Potash	Moorestown
18859	V. C. C. Co.'s Ammoniated Bone Phosphate for All Crops	Jamesburg
18083	V. C. C. Co.'s H. G. Ammoniated Bone Phosphate	Beverly
18896	C & B XXXX Fish and Potash Potato Manure without Potash	Cranbury
18157	V. C. C. Co.'s Double Owl Brand Potato and Truck Fertilizer without Potash	Beverly
	West Jersey Marl & Transportation Co., Woodbury, N. J.	
18248	Brand 4-10-0	Grenloch
18367	Brand 5-10-0	Thorofare
18278	Brand 3-10-0	Gloucester
18596	Brand 2-10-0	Swedesboro
	J. R. Wyckoff, Princeton Junction, N. J.	
18568	Wyckoff's Special Formula	Princeton Junction.
18991	Wyckoff's Special Harrison Formula	Princeton Junction.
18990	Wyckoff's Special Corn Grower	Princeton Junction.
18989	Wyckoff's Three, Ten, Naught	Princeton Junction.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen and Phosphoric Acid

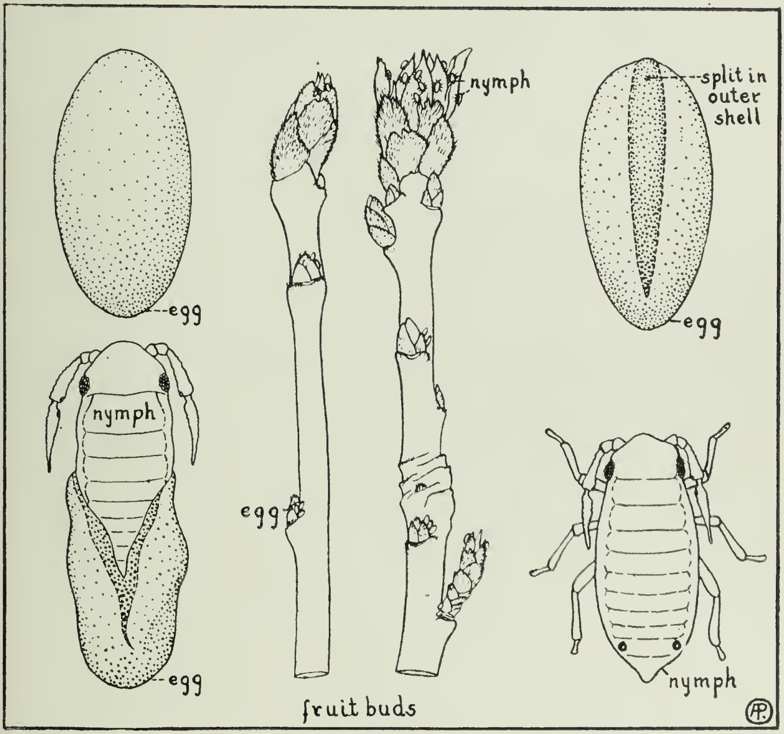
Nitrogen						Phosphoric Acid						
											Available	
As Nitrates	As Ammonia Salts	As Soluble Organic Matter	As Insoluble Organic Matter	Total Found	Total Guaranteed	Soluble in Water	Soluble in Ammonium Citrate	Insoluble	Total Found	Total Guaranteed	Found	Guaranteed
0.21	0.76	0.51	0.93	2.41	2.46	5.14	4.84	1.70	11.68	11.00	9.98	10.00
0.47	0.86	0.21	0.53	2.07	3.30	7.10	3.63	0.83	11.56	11.00	10.73	10.00
....	2.50	0.60	0.92	4.02	4.12	8.72	2.08	0.89	11.69	11.00	10.80	10.00
....	1.07	0.44	0.89	2.40	2.46	7.28	3.71	0.90	11.89	11.00	10.99	10.00
....	1.03	0.59	1.23	2.85	3.30	4.48	2.41	0.48	7.37	5.00	6.89	.....
....	2.54	0.72	0.73	3.99	4.12	1.50	5.82	1.96	9.28	9.00	7.32	8.00
....	0.65	0.33	0.89	1.87	1.64	6.06	4.12	1.13	11.31	11.00	10.18	10.00
0.47	0.14	0.33	[1]0.56	1.50	1.64	5.76	4.72	0.69	11.17	11.00	10.48	10.00
....	0.08	0.32	[2]0.52	0.92	0.82	9.00	3.71	0.84	13.55	13.00	12.71	12.00
....	0.28	0.64	0.73	1.65	1.64	6.24	4.14	7.37	17.75	15.00	10.38	10.00
....	0.46	0.40	0.89	1.75	1.64	6.26	4.30	1.27	11.83	11.00	10.56	10.00
....	0.53	0.45	0.80	1.78	1.64	7.10	3.58	0.70	11.38	11.00	10.68	10.00
....	2.35	0.59	0.69	3.63	3.30	8.00	2.57	1.08	11.65	11.00	10.57	10.00
....	0.22	0.23	0.51	0.96	0.82	2.94	6.90	0.94	10.78	10.00	9.84	9.00
....	0.99	0.11	0.74	1.84	1.64	2.80	7.26	0.86	10.92	11.00	10.06	10.00
0.81	1.28	0.42	0.34	2.85	3.29	6.20	4.49	1.25	11.94	11.00	10.69	10.00
0.24	0.24	0.19	0.27	0.94	0.82	5.50	5.26	1.09	11.85	11.00	10.76	10.00
....	0.78	0.67	0.39	1.84	1.65	6.78	3.20	1.62	11.60	11.00	9.98	10.00
0.67	0.83	0.37	0.50	2.37	2.47	6.50	4.05	1.40	11.95	11.00	10.55	10.00
3.81	0 04	0.06	0.96	4.87	4.94	7.42	0.95	0.47	8.84	9.00	8.37	8.00
0.29	3.44	0.16	0.26	4.15	4.12	9.78	1.37	0.45	11.60	11.00	11.15	10.00
0.31	1.10	0.11	0.35	1.87	1.65	6.74	3.60	1.04	11.38	11.00	10.34	10.00
1.14	0.03	0.14	0.32	1.63	1.65	9.40	2.72	0.92	13.04	13.00	12.12	12.00
....	2.68	0.15	0.42	3.25	3.29	7.04	1.95	0.74	9.73	9.00	8.99	8.00
Tr.	2.36	0.42	0.44	3.22	3.29	6.76	2.71	1.29	10.76	11.00	9.47	10.00
1.15	1.29	0.16	0.71	3.31	3.30	7.84	2.15	2.94	12.93	10.00	9.99	10.00
....	3.45	0.21	0.52	4.18	4.12	9.56	1.39	0.87	11.82	10.00	10.95	10.00
1.00	0.16	0.39	0.76	2.31	2.47	7.12	2.70	3.77	13.59	10.00	9.82	10.00
Tr.	0.76	0.44	[1]0.35	1.55	1.65	7.66	3.32	1.90	12.88	10.00	10.98	10.00
Tr.	2.01	0.35	0.79	3.15	3.29	7.80	2.19	1.36	11.35	10.00	9.99	10.00
0.74	0.75	0.35	1.13	2.97	3.29	5.04	4.24	1.32	10.60	10.00	9.28	10.00
0.57	0.05	0.16	[1]0.72	1.50	1.65	5.62	4.26	1.30	11.18	10.00	9.88	10.00
1.49	0.09	0.20	0.97	2.75	2.47	5.30	4.64	1.60	11.54	10.00	9.94	10.00

[1] Insoluble organic nitrogen of inferior quality.

[2] Insoluble organic nitrogen of inferior quality. Excess of total nitrogen partially offsets quantity of inferior quality.

NEW JERSEY
AGRICULTURAL EXPERIMENT STATIONS

BULLETIN 332



Time to Spray

SOME STUDIES ON THE EGGS OF IMPORTANT APPLE PLANT LICE

NEW BRUNSWICK, N. J.

CONTENTS

NEW JERSEY
AGRICULTURAL EXPERIMENT STATIONS
BULLETIN 332

SOME STUDIES ON THE EGGS OF IMPORTANT APPLE PLANT LICE

By

Alvah Peterson, Ph. D.

Introduction

This paper treats of some recent investigations on the structure, behavior and susceptibility of the eggs of three important aphides found on apple trees, *Aphis avenæ* Fabricius, *Aphis pomi* DeGeer, and *Aphis sorbi* Kaltenbach. It takes up a thorough discussion of the results obtained during the season of 1916-17 which were published in brief form in the *Journal of Economic Entomology* for December, 1917. It also includes a report on the extensive experiments and observations conducted during the past season (1917-18) on the eggs of *A. avenæ*.

A considerable amount of work has been conducted by various investigators on the effect of the more common contact insecticides on aphid eggs, but few if any good reasons have been advanced which explain the varying results. To get at the causes for these results involves a careful study of the physical and chemical structure of the egg, particularly the egg shell and the response of the egg to various stimuli such as temperature, moisture and chemicals. Studies pertaining to all these points have not been made, but some have been conducted, viz., the gross morphology of the egg coverings and their behavior previous to the emergence of the nymph, the susceptibility of the egg to variations in temperature and to different percentages of moisture, and the physical changes produced on the coverings of the egg by a number of common insecticides and other chemicals, and also the influence of these substances on the normal percentage of hatch.

The eggs of the three species of apple plant lice were collected from different orchards throughout the state of New Jersey during the past two seasons. In 1916-1917 the eggs of the so-called apple-bud-aphis, oat-aphis, or European grain-aphis, *A. avenæ*, were abundant in the orchards on the College Farm and at John H. Barclay's orchard, near Cranbury, N. J. During the same season the eggs of the rosy aphis, *A. sorbi*, also occurred in these orchards, but in no collection did they exceed 15 per cent of the total number. The

eggs of the green apple aphis, *A. pomi,* were very abundant on water sprouts in an old unkept orchard near Scott's corner, a few miles from Plainsboro, N. J., 1916-17. On May 1, some eight hundred stem mothers were collected from the water sprouts in this orchard and *A. pomi* made up 71 per cent of the total number, *A. sorbi* 26 per cent, and *A. avenæ* 3 per cent. This count, along with others, shows that *A. sorbi* probably made up 25 to 30 per cent of the total number of eggs.

During the past dormant season, 1917-18, the fall migrants and oviparous females were observed in a number of orchards throughout the state and in the majority of places *A. avenæ* was the only species present; *A. pomi* and *A. sorbi* were comparatively rare in most orchards. The investigations during the past season deal only with *A. avenæ.* Three orchards were chosen for supplying material: John H. Barclay's orchard, near Cranbury, N. J.; George Smith's orchard near South River, N. J.; and J. L. Lippincott Company's orchard, near Riverton, N. J.

All observations made in respect to the location of the eggs of the different species and the time of hatching conform closely with those made by Baker and Turner (2, 3) and other investigators. The eggs of *A. avenæ* and *A. sorbi,* for the most part are deposited under buds or in small crevices in the bark on second-year growth, and to some extent on larger branches, 2 inches in diameter, and occasionally on one-year growth. They are usually distributed evenly throughout the orchard. It has also been noted that varieties of apple trees which retain their leaves the longest in the fall of the year are apt to have the heaviest infestation. This is probably due to the fact that the oviparous female feeds on the under-side of the foliage and when the leaves fall from the tree she may disappear with the leaves, or if she is located on the branches of the tree when the leaves fall she is deprived of the opportunity to obtain food which is probably essential to the development of the greatest number of eggs. The eggs of *A. pomi* are deposited on one-year growth, particularly at the distal ends of water sprouts, and they are often scattered over the smooth surface of the twig. Usually the infestation is local, the eggs being confined to a few twigs on a tree and also not evenly distributed throughout the orchard. Frequently the eggs of *A. pomi* are very abundant in young orchards; this was true of John H. Barclay's orchard in 1915.

During 1917 the eggs of *A. avenæ* started to hatch about March 31, and, so far as observed, had completely hatched by April 6 or 7, while the eggs of *A. pomi* and *A. sorbi* started to hatch about April 12 to 14, and completed hatching in a week or ten days. *A. sorbi* apparently preceded *A. pomi* by two or three days, at least the stage of development of the nymphs after all eggs had hatched indicated

as much. In 1918 the eggs of *A. avenæ* started to hatch on March 21, and completed hatching on April 5. This early hatch was undoubtedly due to the unusually warm weather during March, 1918.

The percentage of eggs which hatch varies among the different species (compare the percentage of hatch in the different checks). Out of 1200 eggs of *A. avenæ*, 50 per cent hatched in 1917, while in 1918 only 30 per cent hatched out of 1800 eggs. The percentage of hatch in the different checks may vary considerably (25 per cent), when only a few eggs (50 to 100) are observed. The decided difference in the percentage of hatch for 1917 and for 1918 of this species is probably due to climatic conditions. The eggs of *A. pomi* and *A. sorbi* during 1916-17 were mixed together on the twigs used in the experiments (approximately 70 and 30 per cent, respectively), and this makes it impossible to determine the percentage of hatch for each, but out of 800 eggs in this mixture, the hatch was close to 25 per cent. The percentage of hatch for *A. pomi* is probably somewhat lower than that of *A. sorbi,* for the eggs of *A. pomi* are scattered promiscuously over the surface of the twigs and thus exposed to accident and to unfavorable weather conditions. The above percentages of hatch are considerably higher than those recorded by other investigators. Gillette, in Colorado, observed that only 1 per cent of the eggs of *A. pomi* hatched. This seems exceptionally low; however, environmental factors, such as a low percentage of humidity, may bring about this decided reeduction.

Methods

All records in the table which pertain to the condition of the eggs, were made by carefully observing each egg under a binocular microscope and then noting whether it was normal, split, hatched or shriveled. In this way one can readily distinguish a normal egg by its plump and well rounded appearance and homogenous surface (plate 1, fig. 1), an egg with its outer semi-transparent covering split shows a distinct glossy black streak *p* usually along the mesodorsal line (plate 1, fig. 2 to 5), a hatched egg possesses a distinct opening in its surface (fig. 8 and 9), and a shriveled egg is dry and collapsed (plate 1, fig. 11 and 12).

During 1916-17 approximately 10,000 eggs were carefully observed, while in 1917-18 over 40,000 eggs were used in the various experiments, and a careful record was made for each egg. Whenever material was needed for experimental purposes, collections were made from the above-mentioned orchards and in all cases this material, when used for out-of-door experiments, was kept out-of-doors and exposed to all conditions of the weather, except for the few minutes required to examine the eggs under a

binocular microscope. Before starting or spraying any set of twigs, all eggs on each twig, 8-12 inches long, were carefully observed and their condition noted. If any egg was shriveled or hatched or appeared to be abnormal in any respect, it was removed; thus in the various experiments only normal-appearing eggs were used. Every twig bearing five or more normal eggs (in exceptional cases 200 eggs of *A. pomi* were present on one small twig) was given a string tag, and on this tag was written the number of the experiment, the source of the material, the treatment given, the number of normal eggs at the beginning of the experiment and in many cases the number of discarded abnormal eggs, and hatched eggs, if such were present.

The various common contact insecticides, lime-sulfur, miscible oils, laundry and fish-oil soaps, nicotine sulfate and nicotine resinate, and other chemicals such as crude carbolic acid, phenol c. p., meta cresol c. p., ortho cresol c. p., para cresol c. p., sodium hydroxide, sodium chloride, sodium sulfo-carbonate, pyridine solution, etc., were applied to the twigs by means of a small atomizer which was connected with a foot pump. The atomizer gave a coarse spray and the force of the spray was weak, for the greatest pressure could not throw the material over three feet. The twigs at the time of spraying were held a few inches from the tip of the atomizer, and, so far as possible, all sides of the twig and all the eggs were hit with the spray. Probably not one egg out of a thousand was missed.

Experiments with the various contact insecticides and chemicals during 1916-17 were conducted in the greenhouse on the eggs of *A. avenæ*, and out-of-doors with the eggs of all three species. In 1917-18 a duplicate set of experiments was started in the greenhouse and out-of-doors with the eggs of *A. avenæ*, but a shortage of coal during the month of February made it necessary to close the greenhouse. The twigs were brought into the laboratory from the greenhouse and placed in a large tin compartment, but the results obtained from these experiments were not as satisfactory as they would have been under greenhouse conditions, consequently they have been largely omitted from this paper. Since it was necessary to close down the greenhouse, a more strenuous effort was made to run a larger number of experiments under out-of-door conditions. The twigs used in the experiments in 1916-17 in the greenhouse were placed in tumblers and these were set on tanglefoot paper in order that the nymphs might not escape. The temperature of the greenhouse averaged 65° F., and the humidity was about 75 per cent most of the time. In all the out-of-door experiments conducted at the laboratory the twigs bearing the eggs were suspended on wires which extended across the tops of large empty wooden boxes. These boxes were located in an open place near the laboratory and completely exposed to all conditions of the weather, thus duplicating, as nearly as possible, the orchard environment. The results

from this laboratory method were very satisfactory during both seasons for they exactly duplicated the results obtained in the orchard where lime-sulphur, lime-sulphur combined with nicotine, and "Scalecide" were used. The loss of eggs in handling the twigs usually did not exceed 10 per cent, and in most cases it was less than 10 per cent. When a few eggs were lost, it is assumed that the loss was proportionally shared by eggs which would hatch under normal conditions and those that would not hatch.

Morphology and Behavior of the Egg

The eggs of *A. avenæ*, *A. pomi* and *A. sorbi* are glossy black, oval in form and slightly flattened on their ventral aspects, adjacent to the twig (plate 1, fig. 1 and 6). The eggs vary somewhat in size, but generally speaking they are about 1/45 inch in length and 1/90 inch in width. According to Baker and Turner (2) the eggs of *A. pomi* average 0.572 mm. by 0.281 mm., and of *A. sorbi* 0.550 mm. by 0.272 mm. The newly laid eggs are soft and retain this consistency, more or less, even after the outer shell hardens. A new egg has a light yellow color which soon changes to a green tinge and then gradually darkens to a deep black. This change usually takes place in a few days, one to four according to Baker and Turner. During the past season it was noted that a small percentage of the eggs of *A. avenæ* required ten or more days to change to a glossy black and some never changed, but retained their greenish tinge throughout the winter. Apparently these eggs are abnormal, for they did not hatch, so far as observed. Other abnormal eggs had a light brown tinge and they did not hatch.

The glossy appearance, particularly true of a newly deposited egg, is due to the moist glutinous layer which entirely surrounds it. This layer *t* hardens and glues the egg to the twig and also acts as a protective layer to conserve the moisture content of the developing embryo. After the outer layer hardens one can remove it by careful dissection, and then its thin, colorless, semi-transparent and somewhat tough consistency can be seen. This layer probably originates as a secretion from accessory glands in the oviparous female, at least such glands are present in the female.

The black or pigmented portion *p* of the egg is entirely confined to the slightly tough and elastic membrane directly beneath the outer semi-transparent layer. The glossy black and moist appearance of this layer is readily observed in eggs where the outer semi-transparent layer *t* has split (plate 1, fig. 2-10). The pigmented layer undoubtedly is a true chorion for it is found about the egg as a distinct pigmented layer when the egg has nearly completed its formation within the oviparous female. The chorion is secreted by the ovarian cells about the ovum. The pigmented layer may serve as a protective covering, but, so far as water conservation is concerned

and also as a protection against certain chemicals, it is of little use, as shown in various experiments.

A third layer, which is a thin transparent membrane, surrounds the nymph as it starts to emerge. This layer is shed by the nymph as it emerges, consequently it must be an exuvium. The cast skin *v* may be seen as a shriveled white mass at the cephalic end of the opening of a hatched egg.

The two layers of the egg and the skin about the nymph as it emerges undergo certain changes at the time of hatching, and these are significant, for they have an important bearing upon the response of the egg to differences in temperature and moisture and to common insecticides and other chemicals. These changes have been observed for two seasons on the eggs of all three species, but they have been observed with special care on the eggs of *A. avenæ.*

In 1917 it was noted that the semi-transparent outer layer *t* of many eggs of all three species splits (plate 1, fig. 4 and 5) along the meso-dorsal line a short time previous to the emergence of the young nymph. The split starts near the cephalic end (plate 1, fig. 4) and usually extends to the posterior end, and in nine cases out of ten occurs along the meso-dorsal line. In exceptional cases the outer layer *t* may show several breaks (plate 1, fig. 2 and 3), or the single split may not follow the meso-dorsal line (plate 1, fig. 9). The time interval between the splitting of the outer layer and the rupture of the pigmented layer was not definitely determined in 1917, for the significance of the splitting was not realized until it was too late to make the necessary observations. It was observed, however, that the eggs of *A. avenæ* under greenhouse conditions showed a split outer covering about 48 hours before any hatching occurred, while the eggs of *A. pomi* under out-of-door conditions showed a split outer shell some eight days before any hatching occurred. During 1918 the first split eggs of *A. avenæ* were seen on February 15. Just previous to this date we experienced a few warm days after a continuously cold and severe winter. From February 15 on, the percentage of eggs showing a split outer covering increased. The eggs were observed in batches of 200 to 500 collected from various orchards. The eggs collected from J. L. Lippincott Company's orchard at Riverton, N. J., showed the following increase in the percentage of eggs with split outer shells (kept out-of-doors) and these observations are typical of eggs collected from other orchards in 1918: February 19, 2 per cent split; February 26, 10 per cent split; March 1, 20 per cent split; March 4, 25 per cent split; March 11, 33 per cent split; March 19, 43 per cent split; and March 25, 47 per cent split (also see diagram 1). So far as observed, about 95 per cent of all the live eggs had broken their outer semi-transparent shell before the first nymphs emerged.

So far as is known, no egg hatched under out-of-door conditions without splitting its outer semi-transparent layer at least 48 hours before the nymph emerged. The above 47 per cent of split eggs observed on March 25 probably increased to 53-55 per cent before all the eggs hatched, at least other checks showed a total of 53 to 55 per cent of eggs with split outer coverings. This 53-55 per cent of eggs with split outer coverings shows that this percentage of eggs was normal, alive and preparing to hatch, but during the past season an average of 29 per cent of all the eggs actually hatched. In other words, 24 to 26 per cent of the eggs after splitting their outer covering were unable to complete the process of hatching.

Eggs of *A. avenæ* (200 collected from J. L. Lippincott Co.) were brought into the laboratory on February 26, 1918, and kept in a moist chamber (70° F.). The percentage of split eggs increased with great rapidity because of the increase in temperature over out-of-door conditions: on February 26, 10 per cent split; February 27, 23 per cent split; March 1, 25 per cent split, and 1 per cent hatched; March 6, 33 per cent split and 10 per cent hatched; March 11, 20 per cent split and 29 per cent hatched; March 13, 9.5 per cent split and 41 per cent hatched; and March 15, 7 per cent split and 43.5 per cent hatched. There was no increase in hatched or split eggs after March 15. The minimum period of time between the splitting of the outer covering and the emergence of the nymph under indoor conditions was not observed; however, so far as known all eggs split their outer shell at least a few hours before emergence.

In these indoor experiments only 28 per cent of the eggs showed a split outer covering when the first nymphs emerged. This means that only 55 per cent of the live eggs which were preparing to hatch had split their outer shell before the first nymphs appeared. This is quite different from the 95 per cent among the live eggs kept out-of-doors. Temperature, therefore, has a marked influence on the rapidity with which the nymph will emerge after the outer shell is broken. In the above indoor experiment it was also observed that 50.5 per cent of all the eggs split their outer shells and that 43.5 per cent of all the eggs hatched. In other words only 7 per cent of the eggs with split outer coverings failed to hatch, while 24 to 26 per cent of the eggs with split outer shells failed to hatch when kept out-of-doors. The explanation for this decided difference is probably due to differences in moisture (evaporating factors) as explained further on.

The splitting of the outer layer is probably due to the pressure exerted along the meso-dorsal line by the developing embryo or nymph. It is also possible that certain secretions may help to dissolve or weaken the brittle outer layer. A careful histological study may throw some light on this question. All eggs with a split,

EXPLANATION OF FIGURES

All figures are known to be typical of *A. avenæ* and *A. pomi* (and probably A. sorbi) unless otherwise designated.

Fig. 1—Dorsal view of a normal dormant egg.

Fig. 2 & 3—Dorsal views of eggs showing unusual types of splitting in the outer semi-transparent covering.

Fig. 4—Dorsal view of an egg showing an early stage in the usual type of splitting of the outer semi-transparent layer.

Fig. 5—Dorsal view of an egg showing an advanced stage in the usual type of splitting of the outer semi-transparent layer.

Fig. 6—Lateral view of egg seen in figure 5 showing the elevated inner pigmented layer, or chorion.

Fig. 7—Dorsal view of an egg of *A. avenæ* showing an early stage in the emergence of the nymph. Note the egg burster on the head of the nymph along the meson and the cut pigmented layer.

Fig. 8—Dorsal view of an empty egg shell showing usual method of splitting.

Fig. 9—Dorsal view of an empty egg shell showing unusual method of splitting.

Fig. 10—Dorsal view of a nymph of *A. avenæ* emerging from an egg; nymph about to free itself completely from the egg.

Fig. 11—Dorsal view of an egg partly shriveled.

Fig. 12—Dorsal view of an egg completely collapsed.

Fig. 13—Dorsal view of an egg, similar to figure 5, which has been sprayed with a 2 per cent solution of crude carbolic acid. Observe the wrinkled outer semi-transparent layer.

Fig. 14—Dorsal view of an egg, similar to figure 5, showing early stage in usual method of shrivel when egg has been treated with various sprays, particularly crude carbolic acid and miscible oils.

ABBREVIATIONS

ant.	Antenna
b.	Egg burster
d.	Depression
e.	Elevation
n.	Nymph
p.	Inner pigmented layer (chorion)
s.	Split or opening in empty hatched eggs
t.	Outer semi-transparent layer
v.	Exuvium (?)

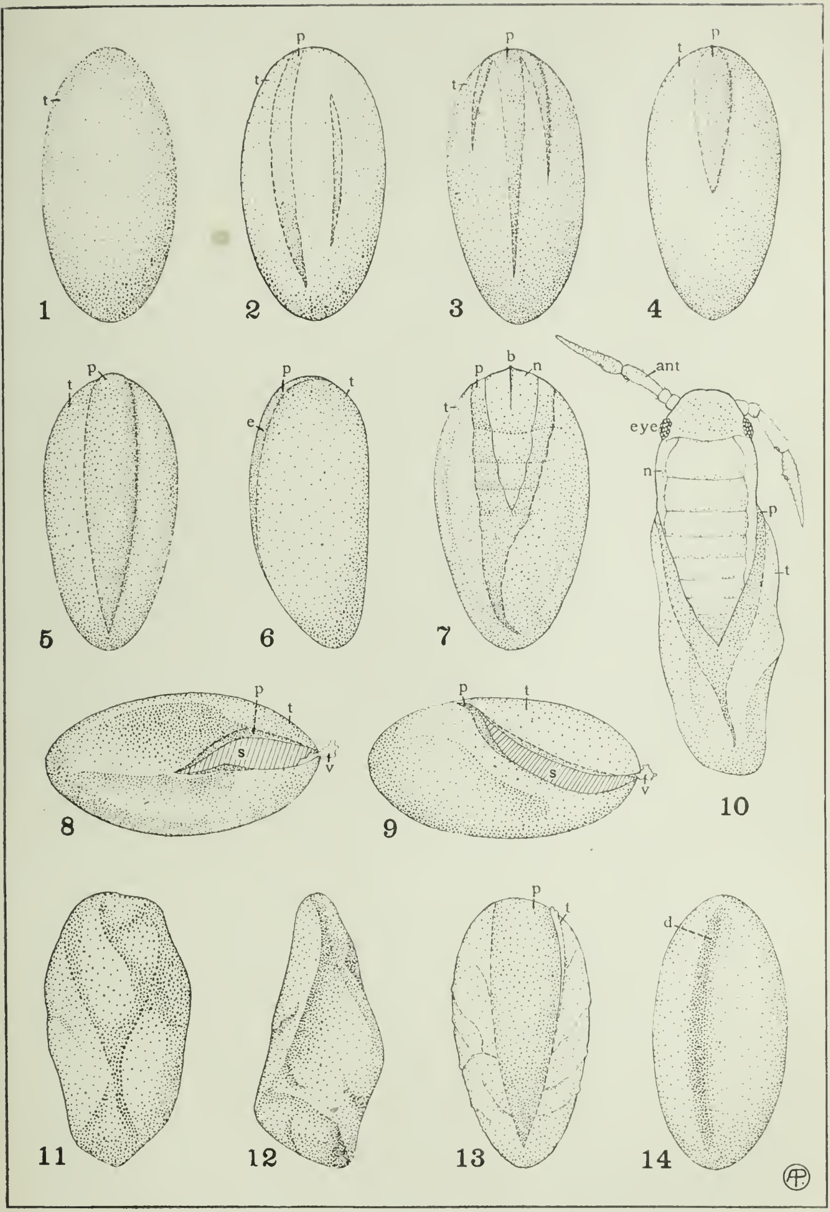


Plate 1. Eggs of *A. avenæ* and *A. pomi*.

outer, semi-transparent shell are readily distinguished from dormant eggs by the decided glossy black appearance of the exposed and unbroken pigmented layer *p*, while the portion of the egg covered with the semi-transparent shell has a duller black color. After the outer shell splits and when the young nymph is ready to emerge it exerts pressure along the meso-dorsal line and severs the pigmented layer (plate 1, fig. 7) with the sharp dark-colored ridge or egg burster *b* located along the meso-dorsal line of the head of the nymph.

The egg burster *b* was observed on the dorsal aspect of the head of *A. avenæ* and *A. pomi*. It coincides with the usual location of the stem of the epicranial suture. During emergence this ridge disappears and only a faint line remains along the meson. No egg burster was seen in the nymphs of *A. sorbi*, but this was probably due to the fact that the nymphs were not seen immediately after they cut their way through the pigmented layer. The origin and disappearance of the egg burster has not been carefully worked out, but it is possible that this ridge or cutting edge belongs to the exuvium or skin which seems to be shed by the nymph as it emerges. If such is the case this will account for its disappearance.

The pigmented layer which is severed by the nymph is somewhat elastic. This is shown in the fact that the egg is a trifle larger at the cephalic end after the outer layer splits. Also, the pigmented layer is elevated to a slight extent between the edges of the broken outer layer, as seen in figures 4, 5 and 6. This elevation is probably due to the pressure exerted by the nymph within the egg as it tries to cut its way out. The elasticity is also shown in hatched eggs, for the pigmented layer contracts somewhat after it is ruptured and the edges of this rupture often coincide with the margin of the broken semi-transparent outer covering (fig. 8 and 9). The wriggling and twisting of the nymph as it emerges may also help to push the pigmented layer back to the point where it coincides with the margin of the split outer shell.

As the nymph of *A. avenæ* starts to emerge it is covered with a thin transparent skin which it sheds before it is out of the shell. This skin is exceedingly thin and very difficult to see. The writer was unable to determine the exact time in the emergence period when the nymphs break this skin. If the egg burster belongs to this first exuvium it is shed a short time before the nymph reaches the stage shown in figure 10. This same membrane in *A. pomi* apparently is not shed until the nymph is almost out of the shell. Observations concerning the above point need to be repeated for all three species. The nymph of *A. avenæ* is usually two-thirds out of the egg before the appendages of the body become free and useful. The antennæ are the first to be free of the exuvium and the

legs come next, starting with the prothoracic. The last appendages to free themselves of the egg and exuvium are the metathoracic legs and mouth-parts. A distinct skin is withdrawn from the beak. This in part probably surrounded the maxillæ and mandibles. The process of hatching is apparently a difficult one, for many nymphs are unable to free their various appendages, especially the metathoracic legs which often remain attached to the white mass of skin at the cephalic end of the open egg. Numerous nymphs are thus killed in the very last stage of hatching. The above fate of many a nymph may be due to the fact that the exuvium hardens on long exposure to air and this makes it very difficult for the nymph to remove the last pair of legs.

The above detailed observations on the morphological structure of the egg and the behavior of the respective coverings during the hatching period (February 15 to April 5 for *A. avenæ)* shows conclusively that the egg is not a hard resistant body and that it goes through a critical change previous to the emergence of the nymph, which means that it is not as resistant during these changes as in the dormant period. It is in the midst of these changes or just previous to any visible change that certain control measures may produce their greatest effect. Some eggs start to split 30 to 35 days before the first nymphs appear, but the largest percentage of split eggs, 47 per cent or better, occurs at the time the first nymphs emerge (only 29 per cent of *A. avenæ* emerged this past season). In brief, the percentage of eggs showing a split outer shell is progressive and this is an important point when one wishes to obtain the best results with certain contact insecticides.

SUSCEPTIBILITY OF EGGS TO MOISTURE AND TEMPERATURE

Moisture

A few experiments have been conducted with the eggs of *A. avenæ* and *A. pomi* to determine the effect of different percentages of moisture on the hatching of the egg and the relative permeability of the two outer layers. The results of these few experiments are very suggestive and undoubtedly have an important bearing on the percentage of hatch which will occur under varying out-of-door conditions. They also throw considerable light on the problem of how certain contact insecticides may prevent hatching.

During 1917 experiments were conducted with different percentages of moisture in the incubators and moisture control apparatus used by Dr. T. J. Headlee in his investigations on grain-infesting insects; the writer wishes to express his appreciation for the privilege of using this efficient apparatus. The four incubators

TABLE 1

Table Showing Effect of Variations in Moisture on Eggs of A. Avenae and A. Pomi at a Constant Temperature of 80° F.

Expt. No.	Eggs of	Percentage of moisture	Started	Observed	Total Eggs	Total Hatch	Total Normal	Total Shriveled	Percentage of Hatch	Days Required to Shrivel Eggs Completely
101	*A. avenae*	Dry	Mar. 25	Mar. 27	25	1	10	14	4	3 days
				Mar. 28	25	1	0	24		
102	*A. avenae*	22	Mar. 25	Mar. 27	25	0	12	13	12	4 days
				Mar. 28	25	0	4	21		
				Mar. 29	25	3	0	22		
103	*A. avenae*	63	Mar. 25	Mar. 27	25	0	19	6	20	10 days
				Mar. 28	25	2	12	11		
				Mar. 29	25	3	7	15		
				Mar. 31	25	3	2	20		
				Apr. 4	25	5	0	20		
104	*A. avenae*	100	Mar. 25	Mar. 27	25	1	24	0	36	10 days
				Mar. 28	25	6	17	2		
				Mar. 29	25	7	14	4		
				Mar. 31	25	7	9	9		
				Apr. 4	25	9	0	16		
105	*A. pomi*	Dry	Apr. 6	Apr. 7	102	2	54	46	2	5 days
				Apr. 9	102	2	5	95		
				Apr. 11	102	2	0	100		
106	*A. pomi*	22	Apr. 6	Apr. 7	101	0	52	49	00	5 days
				Apr. 9	101	0	6	95		
				Apr. 11	101	0	0	101		
107	*A. pomi*	63	Apr. 6	Apr. 7	100	1	73	26	20	8 days
				Apr. 9	100	10	35	55		
				Apr. 11	100	18	5	77		
				Apr. 14	100	20	0	80		
108	*A. pomi*	100	Apr. 6	Apr. 7	100	3	95	2	46	8 days
				Apr. 9	100	45	28	27		
				Apr. 11	100	46	2	52		
				Apr. 14	100	46	0	54		
109	*A. pomi*	Dry	Mar. 14	Mar. 17	175	0	100	75	00	7 days
				Mar. 19	175	0	25	150		
				Mar. 21	175	0	0	175		
110	*A. pomi*	22	Mar. 14	Mar. 17	250	0	210	40	00	11 days
				Mar. 19	250	0	160	90		
				Mar. 21	250	0	50	200		
				Mar. 23	250	0	10	240		
				Mar. 25	250	0	0	250		
111	*A. pomi*	63	Mar. 14	Mar. 17	250	0	235	215	00	24 days
				Mar. 19	250	0	215	35		
				Mar. 21	250	0	195	55		
				Mar. 23	250	0	180	70		
				Mar. 25	250	0	150	100		
				Apr. 4	250	0	50	200		
				Apr. 7	250	0	0	250		
112	*A. pomi*	100	Mar. 14	Mar. 17	125	0	120	5	00	24 days
				Mar. 19	125	0	110	15		
				Mar. 21	125	0	100	25		
				Mar. 23	125	0	85	40		
				Mar. 25	125	0	35	90		
				Apr. 4	125	0	35	90		
				Apr. 7	125	0	0	125		

registered 80°F., and each was fitted with one moisture-control apparatus; one contained dry air which always registered less than 0.5 per cent moisture, another air of 22 per cent moisture, the third about 63 per cent moisture, and the fourth air completely saturated. Practically no variation occurred in the dry air and in the saturated, while in the case of 22 and 63 per cent moistures the amount occasionally fluctuated 1 to 5 per cent. The eggs were carefully selected and removed from the twigs by cutting the bark adjacent to them, or very small twigs bearing numerous eggs were chosen, and these placed in 80cc. glass bottles fitted with rubber stoppers having two short glass tubes which connected the bottle with the moisture-control equipment.

Table 1 shows the results of a few incubator experiments conducted with *A. avena* and *A. pomi*. The various columns are self explanatory; the second from the right gives the total percentage of hatch of all the eggs after all hatched or shriveled, and the column to the extreme right gives the number of days required to shrivel and kill all the eggs. The percentage of hatch might have varied a little in the different experiments if a larger number of eggs had been used; however, the results unquestionably show that different percentages of moisture have a decided influence on the emergence of the nymph. The largest percentage of hatch occurred in saturated air, and practically no hatch in dry air. This decided influence of moisture probably accounts for the low percentage of hatch recorded for *A. pomi* by Gillette (6), in Colorado, where the relative humidity of the climate is much less than at New Brunswick, N. J.

The rate of shrivel of the eggs in the different percentages of moisture in all the experiments is also significant. This is particularly true in the experiments with the eggs of *A. pomi* (exp. 109-112) which never hatched. Eggs of *A. pomi* will not hatch when brought into greenhouse or laboratory temperatures unless it is near the normal out-of-door hatching period, not over 20 to 30 days before hatching.

In experiments 109-112 dry air completely shriveled the eggs in 7 days while saturated air required 24 days. In other words, in these experiments and also in all others pertaining to moisture, the rate of shrivel shows that the water evaporated from eggs in dry air, or 22 per cent humidity, in one-half to one-third the time required for eggs under 63 per cent moisture, or complete saturation. Comparing the rate of shrivel of the eggs in experiments 109-112 started on March 14 with those of the same species (exp. 105-108) started on April 6, the eggs of the latter shriveled more rapidly. This increase in the rate of shrivel is closely correlated with the greater percentage of eggs showing split outer coverings near the hatching period.

The above experiments show that the outer, semi-transparent brittle layer of the egg is permeable to water and cannot conserve the moisture content of the embryo when exposed to adverse dry conditions, but it does conserve a sufficient quantity of moisture under normal out-of-door conditions, so that 25 per cent or more of the eggs hatch. These experiments also indicate that the eggs are most susceptible to drought just previous to the hatching period. This is apparently due to the fact that almost all the normal eggs preparing to hatch show a split outer covering and this splitting of the outer shell exposes the permeable pigmented layer to adverse conditions, thus increasing the rate of evaporation.

A simple experiment was conducted to determine the relative permeability of the pigmented layer and the outer semi-transparent layer. The outer layer *t* was carefully removed from 15 normal eggs of *A. avenea* on April 5, and the plump-skinned eggs were transferred to a Syracuse watch glass with a piece of blotting paper on the bottom. Fifteen normal plump eggs also were placed in the same watch glass and a piece of moist blotting paper was added, but this did not come in contact with any of the eggs. A similar watch glass was used as a cover.

TABLE 2

INFLUENCE OF MOISTURE ON SKINNED EGGS AND NORMAL EGGS

Condition of eggs	90 minutes	4 hours	24 hours	48 hours*	8 days
15 skinned eggs	12 slightly shriveled; 3 normal	15 shriveled; 8 completely collapsed	15 completely collapsed	15 completely collapsed	15 completely collapsed
15 normal eggs	15 normal	15 normal	13 normal; 2 shriveled	11 normal; 2 shriveled; 2 hatched	9 shriveled; 6 hatched

*Observations made between 48 hours and 8 days omitted from table.

The results from these experiments are conclusive; the pigmented or second layer about the egg is very permeable when compared with the outer semi-transparent layer, for the water content of all the skinned eggs was completely evaporated in 24 hours. The normal eggs were much more resistant, for in 24 hours only two eggs showed a slight indication of shriveling, none of the skinned eggs hatched, while 6 of the 15 normal eggs hatched in 4 days. In brief, this experiment shows that the brittle outer layer acts as a preventive agent against water evaporation under normal conditions, while the inner pigmented layer does not perform this function to any great extent.

Under out-of-door conditions the percentage of hatch of the eggs of *A. avenæ* has been observed for two seasons. In 1917

approximately 50 per cent of the eggs of this species hatched, while in 1918 about 30 per cent hatched, a difference of 20 per cent. Among selected eggs used in the checks for experiments conducted out-of-doors from February 19 to April 1, an average of 56 per cent of the eggs hatched in 1917, while 44 per cent hatched in 1918, a difference of 12 per cent. The above difference in the percentages of hatch for the two seasons is believed to be due to the decided difference in the weather. In 1917 we experienced many wet and cold days throughout the last two weeks in February and almost all of March. The last two weeks of March in 1917 were particularly wet (March 15-31). In 1918 the later part of February resembled the same period in 1917, but the entire month of March was comparatively dry, especially the last two weeks, and this weather was very conducive to high evaporation. Unfortunately, only occasional records were made of the humidity during these two years, but in 1918 a number of days in the last weeks of March showed 40 per cent of moisture at mid-day. Table 3 shows the rainfall for the two seasons covering six weeks, February 15 to March 31. A comparison shows immediately a decided difference in the amount of rainfall, especially for the last weeks in March, and these weeks are the most important for at this time the greatest number of eggs have their outer coverings split, thus exposing the permeable pigmented layer to evaporating factors such as low humidity, high temperature and wind velocity. During March 15 to March 31, 1917, 1.59 inches of rain fell, 8 days out of 19 gave over 0.01 inch of rain and 9 days out of 15 were cloudy or partly so, while in 1918, 0.22 inch of rain fell, and only 3 days out of 15 were partly cloudy. During March 15-31, 1917, there was a mean maximum of 53°F., and a mean minimum of 32.1°F., while in 1918 the mean maximum was 59.3°F. and the mean minimum 33.6°F. thus in 1918 there was an increase of 6.3°F. in the mean maximum and 1.5°F. in the mean minimum. This difference in temperature along with the decided difference in rainfall and cloudy days means that the humidity was probably greater in 1917 than in 1918. All the above characteristics of the weather for March, particularly March 15-31, show that the evaporation of moisture from the split eggs would be much greater in 1918 than in 1917, and this being the case the percentage of hatch would be lower for 1918. This is actually true, as shown above among eggs collected from various orchards and also among selected eggs used as checks in various experiments for the two seasons.

TABLE 3

PRECIPITATION FOR FEBRUARY 15 TO MARCH 31, 1917 AND 1918

February	Precipitation		March	Precipitation		March	Precipitation	
	1917	1918		1917	1918		1917	1918
	inches	inches		Inches	Inches		Inches	Inches
15		0.02	1		0.03	17	0.49	
16			2	0.23		18	T	
17			3	T		19		
18			4	1.18		20		
19		0.43	5	0.09	0.18	21	0.17	
20	0.11	0.92	6		0.04	22		
21			7		0.19	23		
22	0.29	0.05	8	0.50		24	0.42	0.22
23	T		9	T	0.02	25		
24	0.37		10		0.20	26		
25			11	0.09		27	0.37	T
26		0.98	12		0.02	28	0.14	T
27	0.03		13			29	T	
28	0.35		14	0.18	0.84	30		
			15	0.01	0.03	31	T	
			16					
Total	1.15	2.40		2.28	1.15		1.59	0.22

T—trace

One may question the influence of humidity on the percentage of hatch for the past season and claim that the smaller percentage was due to the decidedly cold and severe winter (1917-18). The influence of cold weather is questioned by the author for two reasons. In the first place from 50 to 55 per cent of the eggs out-of-doors split their outer coverings, thus giving conclusive evidence that they were alive and preparing to hatch. In the second place, on February 26, eggs were collected from John Barclay's orchard and brought into the laboratory (70°F.) and placed in a chamber which continuously registered 90 per cent moisture or even greater. Of these eggs 50.5 per cent split their outer shells and 43.5 per cent hatched; while a similar lot of eggs (500) from the same collection were kept out-of-doors where the humidity on some of the days (March 15-31, 1918) registered 40 per cent or below at mid-day, and showed only a 29 per cent hatch, or a difference of 14.5 per cent when compared with the indoor experiment. This difference in percentage of hatch is accounted for by the decided difference in the percentage of moisture.

The foregoing experiment, the important observations on the morphological changes which take place in the egg before the nymphs emerge, the records made on the percentage of hatch of *A. avenæ* during the decidedly different seasons of 1917 and 1918 (March 15-31), the results obtained from the experiments conducted with controlled moistures in the incubators during 1917, and the significant facts observed with skinned and normal eggs under laboratory conditions, make us conclude that the percentage of hatch among eggs of apple aphides is influenced to a considerable

extent by weather conditions, especially during the few weeks previous to the emergence of the nymph. In brief, the existence of high evaporating factors during the dormant season, especially after the outer egg shell has split, kills a large number of eggs which would normally complete the process of hatching in weather with low evaporating factors. In order that the above relationship between the percentage of hatch and the condition of the weather may be proved and its significance ascertained, especially in regions where the average humidity is low, it is suggested that observations be made in various states, on the percentage of hatch for the various species concerned.

Temperature

Temperature has a marked and peculiar influence upon the hatching of the eggs of all three species. Some of these influences have been mentioned. In 1917 eggs of *A. pomi* and *A. sorbi* were brought into the greenhouse during February and the early part of March (up to March 14) and these failed to hatch, while eggs of *A. avenæ* brought into the greenhouse at the same time showed a normal percentage of hatch. During 1917-18 eggs of *A. avenæ* collected in November and placed in the greenhouse showed a 10 per cent hatch during the first week in February, while eggs collected on February 26, and put in a moist chamber in the laboratory showed a 43.5 per cent hatch. This difference in the percentage of hatch (also true for other experiments during December and January) may be due to the fact that an exposure to low temperatures is beneficial for the majority of the eggs of *A. avenæ*. As noted before, the greenhouse was closed early in February during 1918 and the transfer of the eggs to a moist tin compartment in the laboratory may have had some influence on the percentage of hatch. In order to be sure of the above statement concerning the eggs of *A. avenæ* it will be necessary to repeat these experiments. Eggs of *A. pomi* and *A. sorbi* will hatch under laboratory or greenhouse conditions provided they are not brought into the laboratory or greenhouse over 20 to 30 days before they normally hatch out-of-doors. The above peculiarity in the hatching of the eggs has also been noted by Baker and Turner (2) and other investigators. For some unknown reason, long exposure to low temperatures is essential for the normal development of the embryo of *A. pomi* and *A. sorbi,* and it may be beneficial for the majority of the eggs of *A. avenæ*.

Temperature also influences the egg when it is preparing to hatch. It was repeatedly noted that the percentage of eggs with a split outer covering would always show a decided increase during or following a day or two of exceptionally warm weather. This was particularly true during the latter part of February and the

early part of March. When the nymphs were emerging (March 21 to April 5) the rate of emergence was influenced by the temperature. On warm days the greatest number came out. The eggs of *A. avenæ* started to hatch on March 21 during the past season, while in 1917 the first nymphs were seen on March 28. This difference is undoubtedly due to the difference in the temperature mentioned above for the last two weeks in March for 1917 and 1918.

After the nymphs have emerged they are somewhat susceptible to low temperatures. At least it was noted that on April 6, 1918, in many unsprayed orchards, especially around Riverton, N. J., the nymphs of *A. avenæ* were very abundant, each bud on some trees showing ten or more. On April 9-11 a severe drop in temperature took place (enough to frost the edges of the small protruding leaves), and a heavy snow and sleet storm accompanied the change in temperature. On April 18 these trees were examined and the heavy infestation was reduced below the danger point; in fact, in some orchards adjacent to the Delaware river no aphides could be found. The results of spraying experiments in this section of the state and likewise in other portions during the past season were not as striking as in 1917, on account of the storm. Possibly the sleet and snow were as beneficial in killing the nymphs as the cold weather.

Contact Insecticides and Other Chemicals

The foregoing morphological and ecological study of the eggs of apple plant lice shows conclusively that they are not as firm and impenetrable as some entomologists would have us believe, and furthermore they are especially susceptible to differences in moisture and temperature a few weeks previous to the emergence of the nymph and also as the nymph emerges. These facts naturally lead us to assume that certain common contact insecticides and various chemicals applied just before the nymphs emerge should affect the eggs and cut down the percentage of hatch. This is unquestionably the case, for a number of investigators using lime-sulfur at winter strength, crude oil emulsion and other sprays have met with success in killing the aphid in the egg stage when the spray was applied late in the season, in most cases just as the buds were bursting. A brief review of these investigations has been made by P. R. Jones (12). Dr. T. J. Headlee's experiments with lime-sulfur in 1916 at John Barclay's orchard also show that the rosy aphis, *A. sorbi*, is killed in the egg stage.

The exact physical and chemical effect of the various sprays on the egg has never been explained and, so far as is known, is still more or less a mystery. In order to understand the chemical reaction of various substances on the egg-shell, it is necessary to

have some knowledge of the chemical nature of the layers about the egg. A few qualitative-tests have been conducted with this point in view, but as yet nothing definite has been determined. From a physical standpoint the effect of certain substances has been observed and these will be discussed briefly.

In order to control the aphid in the egg stage the material used must prevent the nymph from hatching or it may be of such a nature as to kill the nymph as it hatches. The preventive may act in several ways. Any substance which will harden the outer semi-transparent shell and thus makes it impossible for the nymph to emerge would be satisfactory, or the material used could have the opposite effect, that is, soften or dissolve the outer layer and thus expose the inner, pigmented layer to evaporating factors such as wind, heat or low humidity. Furthermore, many substances are splendid dessicating agents and any material possessing this quality might be able to extract the water content of the ovum or embryo and thus prevent further development. Again, the use of any toxic substance which will penetrate the egg coverings and attack the living embryo would naturally be a control measure. Another possible means of control would be the discovery of some chemical which will loosen the egg from the twig and cause it to fall to the ground.

Dormant lime-sulfur apparently hardens the outer covering, at least it was noted that a number of treated eggs did not completely collapse and in many cases the outer layer retained its normal shape while the black pigmented layer and the contents of the embryo within were completely shriveled. Such eggs are easily recognized in that they are lighter in color because of the air space within. Besides this hardening effect, lime-sulfur seems to act as a dessicating agent and it may also actually penetrate all the layers and serve as a toxic substance on the embryo.

So far as could be seen with a microscope, no decided visible effect was evident in eggs treated with other common contact insecticides such as nicotine, soap solutions and miscible oils. In some cases where eggs were treated with miscible oil, particularly oils which possess some crude carbolic derivatives, they appeared to be more glossy. So far as is known, the above substances probably act as toxic agents which kill by penetrating the layers of the egg and attacking the embryo.

A weak solution of crude carbolic acid will soften and apparently disintegrate the outer shell of the aphid egg. In several experiments the eggs of *A. avenæ* and *A. pomi* were sprayed with a 1 per cent and a 2 per cent solution of crude carbolic acid, and with varying strengths of cresol (U. S. P.) plus enough laundry soap to break the surface tension. In a few minutes after treatment

TABLE 4

RESULTS OF SPRAYING EXPERIMENTS WITH EGGS OF A. AVENAE AND A. POMI (A. sorbi) FOR 1917

Number of Exp.	Spray	Species	Date of Spray	Total Eggs	Total Hatch	Percentage Hatched
G- 1	Check	*A. avenae*	Feb. 27	108	91	84.2
G- 2	Check	*A. avenae*	Mar. 7	49	16	32.6
G- 3	Check	*A. avenae*	Mar. 10	70	44	62.8
G- 4	Check	*A. avenae*	Mar. 16	58	37	63.8
G- 5	Check	*A. avenae*	Mar. 27	50	34	68.0
O- 6	Check	*A. avenae*	Mar. 12	68	20	29.5
O- 7	Check	*A. avenae*	Mar. 30	54	32	59.2
O- 8	Check	*A. avenae*	Apr. 3	55	22	40.0
O- 9	Check	*A. pomi*	Apr. 6	221	110	49.7
O-11	Check	*A. pomi*	Apr. 7	104	39	37.5
O-10	Check	*A. pomi*	Apr. 16	104	49	47.2
G-12	Lime-sulfur, 1-8	*A. avenae*	Feb. 27	102	4	3.9
G-13	Lime-sulfur, 1-2	*A. avenae*	Mar. 7	42	0	0.0
G-14	Lime-sulfur, 1-4	*A. avenae*	Mar. 7	52	1	1.9
G-15	Lime-sulfur, 1-8	*A. avenae*	Mar. 7	43	0	0.0
G-16	Lime-sulfur, 1-8, plus pyridine solution, 1-100	*A. avenae*	Mar. 7	42	0	0.0
G-17	Lime-sulfur, 1-8, plus sodium chloride, 1 gm.-5 cc.	*A. avenae*	Mar. 7	45	0	0.0
O-18	Lime-sulfur, 1-8	*A. avenae*	Mar. 12	53	1	1.8
O-19	Lime-sulfur, 1-4	*A. avenae*	Mar. 12	50	0	0.0
O-20	Lime-sulfur, 1-8, plus sodium chloride, 1 gm.-5 cc.	*A. avenae*	Mar. 12	54	0	0.0
O-21	Lime-sulfur, 1-4, plus sodium chloride, 1 gm.-5 cc.	*A. avenae*	Mar. 12	50	1	2.0
O-22	Lime-sulfur, 1-8	*A. avenae*	Mar. 30	50	1	2.0
O-23	Lime-sulfur, 1-8	*A. pomi*	Apr. 6	219	16	7.3
O-24	Lime-sulfur, 1-8	*A. pomi*	Apr. 16	107	5	4.6
O-25	Lime-sulfur, 1-8, plus "Black-leaf 40", 1-500	*A. pomi*	Apr. 16	103	1	0.9
G-26	"Mechling's Scale-Oil", 1-9.5	*A. avenae*	Mar. 10	49	4	8.1
G-27	"Mechling's Scale-Oil", 1-19	*A. avenae*	Mar. 10	47	3	6.3
G-28	"Mechling's Scale-Oil", 1-19, plus crude carbolic, 2%	*A. avenae*	Mar. 10	52	0	0.0
O-29	"Mechling's Scale-Oil", 1-19	*A. avenae*	Mar. 30	49	4	8.1
O-30	"Mechling's Scale-Oil", 1-19, plus crude carbolic, 2%	*A. avenae*	Mar. 30	53	0	0.0
O-31	"Mechling's Scale-Oil", 1-19	*A. pomi*	Apr. 7	105	9	8.5
O-32	"Mechling's Scale-Oil", 1-19, plus fish-oil soap 1 gm.-200 cc.	*A. pomi*	Apr. 7	102	10	9.8
O-33	"Mechling's Scale-Oil", 1-19, plus crude carbolic, 2%	*A. pomi*	Apr. 7	175	0	0.0
G-34	"Scalecide", 1-15	*A. avenae*	Mar. 27	52	12	23.0
G-35	"Scalecide", 1-15, plus crude carbolic, 2%	*A. avenae*	Mar. 27	51	2	3.9

O-36	"Scalecide", 1-15	*A. avenae*	Mar. 30	52	18	34.6
O-37	"Scalecide", 1-15, plus crude carbolic, 2%	*A. avenae*	Mar. 30	51	0	0.0
O-38	"Scalecide", 1-15	*A. pomi*	Apr. 6	207	46	22.8
O-39	"Scalecide", 1-15, plus crude carbolic, 2%	*A. pomi*	Apr. 6	192	2	1.0
O-40	"Scalecide", 1-15	*A. pomi*	Apr. 16	110	35	31.7
O-41	Laundry soap, 1 gm.-200 cc.	*A. avenae*	Apr. 3	51	20	39.2
O-42	L. soap, 1 gm.-200 cc., plus "Black-leaf 40", 1-100	*A. avenae*	Apr. 3	50	8	16.0
O-43	L. soap, 1 gm.-200 cc., plus "Black-leaf 40", 1-250	*A. avenae*	Apr. 3	51	6	11.7
O-44	L. soap, 1 gm.-200 cc., plus "Black-leaf 40", 1-500	*A. avenae*	Apr. 3	49	11	22.4
G-45	Laundry soap, 1 gm.-200 cc.	*A. avenae*	Mar. 10	56	22	39.2
G-46	L. soap, 1 gm.-200 cc., plus crude carbolic, 2%	*A. avenae*	Mar. 10	41	1	2.4
G-47	L. soap, 1 gm.-200 cc., plus crude carbolic, 5%	*A. avenae*	Mar. 10	41	0	0.0
G-48	L. soap, 1 gm.-200 cc., plus crude carbolic, 0.5%	*A. avenae*	Mar. 27	54	19	35.1
G-49	L. soap, 1 gm.-200 cc., plus crude carbolic, 1%	*A. avenae*	Mar. 27	50	3	6.0
G-50	L. soap, 1 gm.-200 cc., plus crude carbolic, 2%	*A. avenae*	Mar. 27	49	0	0.0
G-51	L. soap, 1 gm.-200 cc., plus crude carbolic, 5%	*A. avenae*	Mar. 27	50	0	0.0
O-52	L. soap, 1 gm.-200 cc., plus crude carbolic, 2%	*A. avenae*	Mar. 12	45	1	2.2
O-53	Laundry soap, 1 gm.-200 cc.	*A. avenae*	Mar. 30	50	22	44.0
O-54	L. soap, 1 gm.-200 cc. plus crude carbolic, 0.5%	*A. avenae*	Mar. 30	52	8	15.3
O-55	L. soap, 1 gm.-200 cc. plus crude carbolic, 1%	*A. avenae*	Mar. 30	49	7	14.3
O-56	L. soap, 1 gm.-200 cc. plus crude carbolic, 2%	*A. avenae*	Mar. 30	50	2	4.0
O-57	L. soap, 1 gm.-200 cc. plus crude carbolic, 5%	*A. avenae*	Mar. 30	51	0	0.0
O-58	L. soap, 1 gm.-200 cc. plus crude carbolic, 10%	*A. avenae*	Mar. 30	50	0	0.0
O-59	Laundry soap, 1 gm.-200 cc.	*A. pomi*	Apr. 6	200	68	34.0
O-60	L. soap, 1 gm.-200 cc. plus crude carbolic, 2%	*A. pomi*	Apr. 6	205	3	1.4
G-61	Fish-oil soap (solid), 1 gm.-200 cc., plus crude carbolic 2%	*A. avenae*	Feb. 27	53	2	3.7
G-62	Fish-oil soap (solid), 1 gm.-200 cc., plus crude carbolic 5%	*A. avenae*	Feb. 27	47	0	0.0
G-63	Fish-oil soap (solid), 1 gm.-10 cc.	*A. avenae*	Mar. 27	51	2	3.9
O-64	Fish-oil soap (solid), 1 gm.-200 cc., plus crude carbolic 2%	*A. avenae*	Mar. 12	51	1	1.9
O-65	Fish-oil soap (solid), 1 gm.-25 cc.	*A. pomi*	Apr. 7	100	2	2.0
O-66	Fish-oil soap (solid), 1 gm.-50 cc.	*A. pomi*	Apr. 7	100	5	5.0
O-67	Fish-oil soap (solid), 1 gm.-100 cc.	*A. pomi*	Apr. 7	102	2	2.0
O-68	Fish-oil soap (solid), 1 gm.-25 cc., plus crude carbolic 1%	*A. pomi*	Apr. 7	105	1	0.9
O-69	Fish-oil soap (solid), 1 gm.-50 cc., plus crude carbolic 1%	*A. pomi*	Apr. 7	110	0	0.0
O-70	Fish-oil soap (solid), 1 gm.-100 cc., plus crude carbolic 1%	*A. pomi*	Apr. 7	99	0	0.0
O-71	Fish-oil soap (solid), 1 gm.-200 cc., plus crude carbolic 2%	*A. pomi*	Apr. 16	100	2	2.0
G-72	Sodium hydroxide, 2 gm.-98 cc.	*A. avenae*	Mar. 10	31	3	9.6
G-73	Sodium hydroxide, 2 gm.-98 cc.	*A. avenae*	Mar. 12	54	1	1.8
O-74	Sodium chloride, 1 gm.-5 cc.	*A. avenae*	Mar. 13	52	11	21.1
G-75	Sodium chloride, 1 gm.-5 cc.	*A. avenae*	Mar. 16	50	21	42.4
G-76	L. soap, 1 gm.-200 cc., plus sodium sulfocarbonate, 1-19	*A. avenae*	Mar. 10	39	6	15.3
G-77	L. soap, 1 gm.-200 cc. plus sodium sulfocarbonate, 1-9	*A. avenae*	Mar. 10	38	1	2.6
O-78	L. soap, 1 gm.-200 cc., plus pyridine solution, 2%	*A. avenae*	Mar. 10	45	26	57.7
O-79	L. soap, 1 gal. 200 cc., plus pyridine solution, 1% plus crude carbolic 1%,	*A. avenae*	Mar. 10	45	6	13.3

G—Greenhouse and O—Out-of-door Experiments.

the brittle outer layer, split or whole, was softened and wrinkled (plate 1, fig. 13) and could be easily removed. Furthermore, it was noted that in all experiments where crude carbolic acid was used as a spray, especially in strengths greater than 1 per cent, the eggs had an unusually bright shiny appearance after the spray had dried. This glossy appearance indicates that the semi- transparent outer layer has undergone some sort of a change. It was also observed that many eggs with split outer coverings treated with crude carbolic acid and cresols shriveled along the meso-dorsal line (plate 1, fig. 14). This type of shrivel which also takes place to some extent with other treatments indicates that the pigmented layer of an egg showing a split outer shell is particularly susceptible to various chemicals. Furthermore, treated eggs with a whole outer covering frequently shriveled in a like manner. This indicates that the outer shell is weakest along the meso-dorsal line and any foreign material which can soften or disintegrate the outer layer would naturally penetrate this portion of the egg first and cause it to show its early stage of shriveling along the least resistant portion.

A number of other chemicals were tried and their effect noted, but their mode of attack has not been observed with sufficient care to warrant a statement at this time. Possibly it would be worth while to call attention to the fact that sodium hydroxide seems to react upon the glutinous layer in such a manner as to loosen the egg from the tree and cause it to fall to the ground. At least a large number of eggs were lost in all the experiments with sodium hydroxide.

A large number of experiments were conducted with various common sprays and other chemicals during March and April, 1917, and the results of the more important of these are recorded in table 4. The predominant species of eggs used in the various experiments is indicated in the table. In the experiments with *A. avenæ* a few eggs of *A. sorbi* were present, but, so far as is known, these never exceeded 15 per cent of the total number, while in the experiments with *A. pomi* the eggs of *A. sorbi* ran close to 30 per cent (at least a number of counts of newly-hatched stem mothers gave this approximate percentage). This percentage of the eggs of *A. sorbi* in the experiments shows that the eggs of this species resemble those of *A. avenæ* and *A. pomi* in their response to various stimuli; however, there is apparently some difference in the susceptibility of the different species. At least there is good indication of this if one compares the percentages of hatch among the different species under similar treatments. *A. avenæ* is probably somewhat more susceptible than either *A. pomi* or *A. sorbi*. Another point of interest in respect to susceptibility is the fact that all eggs of

one species are not alike; some are less resistant than others, consequently some are killed by weaker strengths of insecticides. This is well illustrated in all experiments, particularly in the experiments where the percentage of hatch runs between 10 and 25 per cent among treated eggs.

The percentages of hatch or kill in all the spraying experiments in the greenhouse or out-of-doors at the laboratory for the two seasons are figured on the basis of considering the number of eggs present at the time the final observations were made. In a former paper (19) the percentage of hatch was figured on the basis of considering the percentage of hatch in respective checks for each set of experiments as 100 per cent, and then the number of eggs hatched in the various experiments compared with the check. Experience has shown that this method is subject to considerable variation due to the variation in the percentage of hatched eggs in the checks; consequently, this method was abandoned for the above mentioned form. In all the tables the percentage of hatched eggs is given for each experiment and one may obtain the percentage of killed or dead eggs by subtracting the percentage of hatched eggs from 100 per cent. The results given in table 4 will be considered in the various discussions on the different insecticides and chemicals.

Upon completing the investigations on the aphid eggs for the season of 1916-17, it was observed that the susceptibility of the eggs to various insecticides and different percentages of humidity seemed to be greatest just prior to the emergence of the nymph. With this observation in mind, a large series of spraying experiments, starting with November 30, 1917 and continuing until April 1, 1918, were conducted out-of-doors at the laboratory for the purpose of determining the relative susceptibility of the eggs throughout the dormant season.

Diagram 1, by an intersection of plotted lines with perpendicular lines (representing dates of application) shows the results of the more important experiments conducted with the eggs of *A. avenæ*. The dates at the top of the chart indicate the time of application of the various substances used. Other applications were made throughout the month of December and January, but the results of the spraying experiments for December 15 are typical of all these. The points of intersection of the various types of plotted lines with the perpendicular date lines indicate the percentage of hatch if one examines the column of figures to the left, and the percentage of dead eggs if one examines the column of figures to the right. Each treatment or substance used as a spray is given a definite letter, the explanation of which may be found at the bottom of the chart. The chart also shows at the top the source or orchard where the eggs were collected and on the bottom

line the percentage of eggs showing a split outer shell at the time the treatment was given. The average percentage of hatch, 48 per cent, or percentage of dead eggs, 52 per cent, for the untreated eggs, or checks is represented by a straight line.

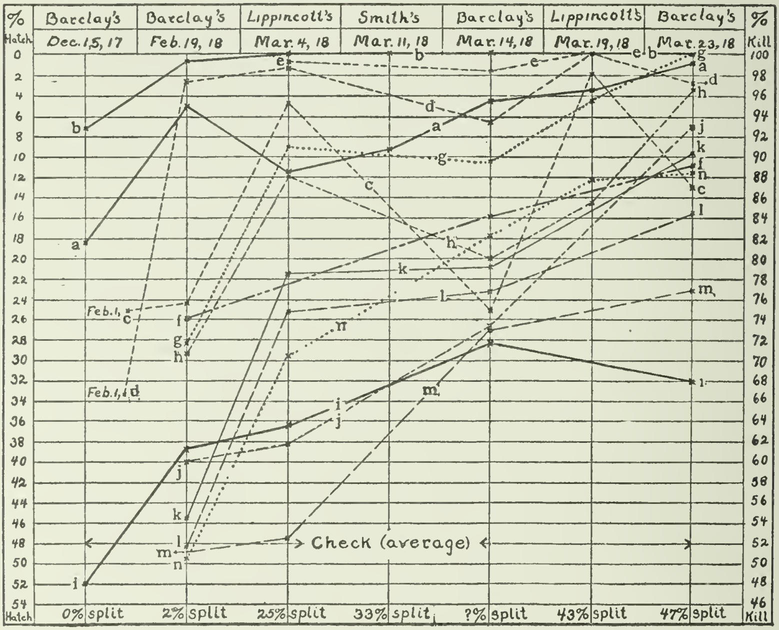


Diagram 1. Chart showing progressive decrease in the percentage of hatched eggs or increase in the percentage of dead eggs with the various sprays when they are applied nearer the time when the nymphs emerge (Emergence March 21 to April 5).

a—Lime-sulfur, 1-9

b—Lime-sulfur, 1-9 plus nicotine, 1-500

c—"Scalecide," 1-15

d—"Scalecide," 1-40 plus cresol, 1%

e—"Scalecide," 1-15 plus crude carbolic, 1%

f—F. o. soap, 1 gm.-50 c. c. plus phenol, 1%

g—F. o. soap, 1 gm.-50 c. c. plus nicotine, 1-500

h—F. o. soap, 1 gm.-50 c. c. plus crude carbolic, 1%

i—Laundry soap, 1 gm.-200 c. c. plus cresol, 1%

j—F. o. soap, 1 gm.-100 c. c. plus crude carbolic, 0.5%

k—F. o. soap, 1 gm.-100 c. c. plus cresol, 1%

l—Fish oil soap (solid), 1 gm.-50 c. c.

m—Resin fish oil soap, 1 gm-50 c. c.

n—Nicotine resinate, 1-500

Several interesting and important points are brought out in this chart, but the most striking and significant one is the fact that almost all the substances used show a gradual progressive decrease in the number of eggs hatched (or vice versa, a progressive increase in the number of dead eggs), when the spray is applied nearer the

time when the nymphs emerge. In all the experiments, no matter what substance was used, the percentage of hatched eggs was less when the substance was applied on March 23 than when applied in December, January, February or March 4.

Briefly stated, the greatest number of eggs are killed in all the experiments when the spray is applied just prior to the emergence of the nymph. This gradual increase in susceptibility is dependent upon the increase in the percentage of eggs showing split outer shells. On the basis of the facts shown in the chart and from foregoing observations on the morphology and behavior of the egg previous to the emergence of the nymph, we may conclude that the greater the percentage of eggs possessing split outer shells the greater will be the percentage of dead eggs when contact insecticides are used.

LIME-SULFUR

A large number of experiments were conducted on the eggs of all the species in the greenhouse, out-of-doors at the laboratory, and in various orchards during the past two seasons, using different strengths of lime-sulfur and lime-sulfur combined with nicotine. During February, March and April, 1917, experiments G-12 to G-17 and 0-18 to 0-25 (table 4), were performed in the greenhouse (G) and out-of-doors (0) with the eggs of all three species, and the results show a very decided reduction in the percentage of hatched eggs and in some instances a complete kill. Eggs of *A. avenæ* sprayed with lime-sulfur 1-8 and kept under greenhouse conditions or out-of-doors at the laboratory showed a very small percentage of hatch or a complete kill (3.9 to 0.0. per cent hatch). Eggs of *A. pomi* receiving similar treatment showed a 2.0 to 7.3 per cent hatch. A comparison of these percentages among the two predominant species in the respective experiments shows that the eggs of *A. avenæ* are more susceptible to lime-sulfur than *A. pomi*. Lime-sulfur 1-6 and greater strengths gave better control than 1-8 or 1-9.

In a few experiments lime-sulfur was combined with sodium chloride, a pyridine solution and nicotine sulfate. The results of the experiments with the first two chemicals mentioned are discussed under other chemicals. During 1917 one experiment (exp. 0-25, table 4) was conducted out-of-doors at the laboratory with the eggs of *A. pomi* where nicotine, "Black-leaf-40", was used at the rate of 1-500 and the percentage of hatch was 0.9 per cent, while another experiment with lime-sulfur, 1-8 (exp. 0.24, table 4) gave a 4.6 per cent hatch. These results indicated the possibility of obtaining a more perfect control when a combination spray was used, consequently a large number of experiments were conducted

TABLE 5

EXPERIMENTS WITH LIME-SULFUR AND LIME-SULFUR COMBINED WITH NICOTINE ("Black-leaf 40") ON SELECTED EGGS OF A. AVENAE,

Spray	Lime-sulfur, 1-9		Lime-sulfur, 1-6		Lime-sulfur, 1-9 "Black-leaf 40", 1-250		Lime-sulfur, 1-9 "Black-leaf 40", 1-500		Lime-sulfur, 1-9 "Black-leaf 40", 1-1,000		Check	
Date Sprayed and Source of Eggs	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched
Dec. 15, 1917 Smith's	72 h 186	38.6			2 h 70	2.8	28 h 140	16.6	4 h 81	4.9	134 h 215	62.2
Dec. 15, 1917 Barclay's	38 h 208	38	18.2		4 h 94	4.2	11 h 154	7.1	14 h 95	14.7	116 h 246	47.1
Feb. 19, 1918 Barclay's	8 h 164	4.8			0 h 9[illegible]	0.0	1 h 172	0.6	0 h 108	0.0	128 h 278	46.0
Mar. 4, 1918 Lippincott's	12 h 99	12.1	0 h 109	0.0			0 h 114	0.0	0 h 103	0.0	45 h 135	33.3
Mar. 11, 1918 Smith's	8 h 85	9.4	4 h 89	4.4			0 h 103	0.0			62 h 130	47.6
Mar. 14, 1918 Barclay's	5 h 110	4.5	0 h 110	0.0			0 h 109	0.0	0 h 105	0.0	97 h 212	45.7
Mar. 19, 1918 Lippincott's	4 h 104	3.8	1 h 84	1.1			0 h 112	0.0	0 h 95	0.0	89 h 201	44.2
Mar. 22, 1918 Barclay's	1 h 104	0.9	0 h 89	0.0			0 h 115	0.0	0 h 98	0.0	34 h 104	32.6

h—hatched eggs.

with varying strengths of lime-sulfur alone and in combination with nicotine during the past season (1917-18). The results of these experiments conducted on the eggs of *A. avenæ* out-of-doors at the laboratory are shown in condensed form in table 5. Some of the series of experiments are also shown in diagram 1 (p. 27).

Table 5 shows in the left column the date of application of the spray and the source of the eggs for each experiment in the various series, while the top line gives the treatment in each series. The table also shows for each experiment the number of eggs hatched *h*, the total number of eggs in the experiment and the percentage of hatch. If one chooses to express the effectiveness of the different sprays in terms of the percentage of kill, subtract the percentage of hatch from 100 per cent. The following example explains what is shown for each experiment. The experiment in the upper left corner shows that the eggs were collected from Smith's orchard and sprayed on December 15 with lime-sulfur 1-9. After they had completed hatching, 72 had hatched out of 186, or 38.6 per cent. Subtracting 38.6 per cent from 100 per cent gives 61.4 per cent killed. This experiment alone shows the ineffectiveness of applying lime-sulfur to eggs during the month of December. The same thing also holds for the month of November, January and the first part of February. The results of the various series of experiments for the above months are not shown in the table, since they are similar to those obtained in December.

The table summarizes the results of the experiments conducted out-of-doors with lime-sulfur and nicotine, consequently it will not be necessary to give a detailed discussion of the various interesting experiments. An examination of the table shows off-hand, in all the series of experiments where the same material was used, that the greatest reduction in the percentage of hatch always occurred where the treatments were applied near the time of the emergence of the nymph. These observations, then, fully agree with a former statement—the greater the percentage of eggs showing a split outer shell, the greater the percentage of kill. Lime-sulfur 1-9 during the past season did not kill 100 per cent of the eggs in any one experiment; however, it did kill 99.1 per cent on March 22; but lime-sulfur 1-6 was more effective, and in two experiments during March killed 100 per cent of the eggs. Lime-sulfur 1-9 combined with nicotine 1-500 or 1-1000 killed 100 per cent of the eggs when applied during the month of March. According to these experiments nicotine at the rate of 1-1000 when combined with lime-sulfur 1-9 is just as effective in killing the eggs as nicotine at the rate of 1-500. This may be true for eggs of *A. avenæ*, but when one wishes to kill 100 per cent of the nymphs that have hatched, the nicotine should be used at the rate of 1-500, as shown by Dr. T. J. Headlee in experiments conducted on apple plant lice during 1916.

Orchard Experiments

During the past two seasons the author has made detailed records on results obtained in various orchards throughout the state, and we are indebted to various owners and managers of orchards for cooperation in this work. In 1917 careful observations were made at Mr. John H. Barclay's orchard. Mr. Barclay delayed the spraying with dormant lime-sulfur 1-9 until the buds started to swell, in order that the spray might be applied near the

TABLE 6

EFFECT OF DORMANT LIME-SULFUR 1-9 ON EGGS OF A. AVENAE DURING THE HATCHING PERIOD, AT JOHN H. BARCLAY'S ORCHARD

(1917)

No.	Date Sprayed Collected	Date Observed	Total Eggs	Number and Percentage of Eggs Hatched	Number and Percentage of Normal Eggs	Number and Percentage of Eggs Shriveled
1	Sprayed April 4 and	April 4	504	116 23.2%	184 36.3%	204 40.5%
	Collected April 4	April 11	504	119 23.5%	45 8.9%	304 67.4%
2	Sprayed April 2 and Collected April 14	April 16	564	118 20.9%	11 2%	435 77%
3	Check: Collected	April 3	360	103 28.3%	116 33%	141 39%
	March 31	April 14	360	118 32%	4 1%	238 66.1%
4	Check. Collected	April 5	466	275 59%	56 14%	135 27%
	March 24	April 14	466	299 64.1%	10 2.1%	157 33.7%

hatching period of *A. sorbi*. Dr. Headlee's observations show that during 1916 the rosy aphis started to hatch on April 15 in this orchard. Dormant lime-sulfur 1-9 was sprayed on the trees west of the house on March 31, 1917, and on the block east of the house on April 2, 1917. To our surprise, it was discovered that the eggs were actively hatching at this time, but the nymphs proved to be *A. avena*. The out-of-door experiments at the laboratory showed some hatch on March 30 and over 20 per cent had hatched by April 2. Mr. Barclay continued to put on the lime-sulfur after

April 2 but added "Black-leaf 40" at the rate of 1-500 in order to kill the nymphs. Lime-sulfur 1-9 alone will not kill all the nymphs of any of the three species. A large number of nymphs and adults of each species were sprayed with lime-sulfur 1-9 in the laboratory and only a few were killed, *A. pomi* being the most susceptible. This also agrees with Dr. Headlee's (9, 10) experiment with *A. sorbi* in 1916, where nymphs lived and apparently did not suffer with lime-sulfur on their bodies. Regardless of the fact that the lime-sulfur was not applied before the eggs of *A. avenæ* started to hatch, an interesting series of observations were made which show conclusively that lime-sulfur is effective in killing the egg during the hatching period. Two collections were made from the trees in the block east of the house before the spray was put on and

TABLE 7

RELATION BETWEEN PERCENTAGE OF HATCH, PERCENTAGE OF NORMAL EGGS AND PERCENTAGE OF SHRIVELED EGGS AMONG SPRAYED EGGS AND EGGS IN CHECK IN TABLE 6

Check (3) Observed Apr. 3	Sprayed Eggs (1) Observed Apr. 4	Difference
28.3% hatched	23.2% hatched	= (a) 5.1% difference in hatch
33% normal	36.3% normal	= (b) 3.3% difference in normal
39% shriveled	40.5% shriveled	= (c) 1.5% difference in shriveled
Equation: (b) 3.3% + (c) 1.5% = (b+c) 4.8%. approximately equals (a) 5.1%.		
Check (4) Observed Apr. 5	**Sprayed Eggs (1) Observed Apr. 4**	**Difference**
59% hatched	23.2% hatched	= (a) 35.8% difference in hatch
14% normal	36.3% normal	= (b) 22.3% difference in normal
27% shriveled	40.5% shriveled	= (c) 13.5% difference in shriveled
Equation (b) 22.3% + (c) 13.5% = (b+c) 35.8%, equals (a) 35.8%.		

Note: For complete information read discussion.

the percentage of hatch in these checks was two or three times as great as in the sprayed twigs collected after the lime-sulfur was applied. Table 6 shows the various percentages of hatch and percentages of shriveled and normal eggs found in this portion of the orchard.

If lime-sulfur is a good control measure, then at any period of observation the percentages of hatch on the spray twigs should not show a marked increase over the first observation of April 4 which was made 12 hours after the spray was put on. The first observation on sprayed eggs showed a 23.2 per cent hatch, and a second observation on April 11, which was about five days after all normal eggs had hatched, showed 23.5 per cent hatched, giving a 0.3 per cent increase. On April 14, another collection of twigs

was made and out of 564 eggs, 20.9 per cent had hatched, thus showing conclusively that there was no appreciable increase in hatch after the lime-sulfur was applied. Furthermore, in comparing the percentage of hatch among the sprayed eggs with that of eggs receiving no treatment, it is evident that the following interrelationship between the percentages should hold. If the lime-sulfur acts as a control, then the percentage of hatch will not increase among sprayed eggs, while normal untreated eggs will continue to hatch. The percentage of hatch, then, in sprayed eggs is a constant number. If such is the case, then the difference (a) between the percentage of hatch in sprayed eggs and the percentage of hatch in untreated eggs should at any time equal the difference (b) between the percentage of normal eggs among the sprayed eggs and the percentage of normal eggs among the untreated eggs plus the difference (c) between the percentage of shriveled eggs among the sprayed eggs and the percentage of shriveled eggs among the

TABLE 8

RESULTS OF SPRAYING WITH LIME-SULFUR, AND LIME-SULFUR COMBINED WITH NICOTINE WHEN THE NYMPHS WERE EMERGING AT JOHN H. BARCLAY'S ORCHARD IN 1918

Date Observed	Check		Lime-sulfur 1-9		Lime-sulfur 1-9 "Black-Leaf 40" 1-500	
	Hatched Eggs and Total Eggs	Percentage Hatched	Hatched Eggs and Total Eggs	Percentage Hatched	Hatched Eggs and Total Eggs	Percentage Hatched
April 1	55 h 243	22.0	19 h 191	10.0	27 h 292	9.2
April 8	77 h 243	35.8	29 h 191	15.0	29 h 292	9.6
April 1	150 aphides to 100 buds		5 aphides to 100 buds		0 aphides to 100 buds	
April 5	350 aphides to 100 buds		25 aphides to 100 buds		10 aphides to 100 buds	

untreated eggs. Table 7 shows this comparison for the observations made on April 3, 4 and 5 in experiments 1, 3 and 4. The same relationship will hold for observations made on April 11 and 14, but these have not been included in this discussion.

The figures in table 6 and 7 show that lime-sulfur sprayed on the eggs of *A. avenæ* during the hatching period prevented 99 per cent of the eggs from hatching which had not hatched at the time of application.

Several careful examinations were made throughout the orchard during the month of April and only an occasional aphid could be found, one or two per tree. Nearby orchards along with one unsprayed tree in Barclay's orchard showed a heavy infestation, approximately five aphides to a bud. Examinations made the latter part of May and in June showed practically no *A. avenæ* on trees sprayed with lime-sulfur or combined lime-sulfur and

nicotine, but some of the trees did show a few clusters of curled leaves due to *A. sorbi,* rosy aphis. *A. sorbi* is somewhat more resistant than *A. avenæ.*

During 1918 careful observations were made on spraying operations conducted in several orchards throughout the state. At John H. Barclay's orchard near Cranbury the first nymphs emerged on March 21, and 10 per cent of the eggs had hatched on March 30 when lime-sulfur 1-9 was sprayed on 150 nine-year-old apple trees (Duchess). On April 1 about 80 trees of the same variety were sprayed with a combination of lime-sulfur 1-9 and nicotine 1-500. A large number of twigs were collected from sprayed and unsprayed trees and observed on April 1, about ten hours after the combined spray was applied. Since the nymphs were emerging very rapidly on April 1, the difference between the percentage of hatch in the sprayed and unsprayed twigs observed on April 1 can be in part accounted for in the delay of ten hours before the observations could be made. Table 8 shows the effect of the sprays on the eggs and nymphs when the nymphs were emerging.

On April 8 after all the normal eggs had hatched it was noted that the number of hatched eggs on the unsprayed branches increased 13.5 per cent, while the percentage of hatch among eggs sprayed with lime-sulfur 1-9 showed a 5 per cent increase and those sprayed with a combination of lime-sulfur and nicotine did not increase more than 0.5 per cent. This experiment shows that eggs are killed with lime-sulfur sprays and also brings out the increased effectiveness of a combination spray of lime-sulfur and nicotine over lime-sulfur alone.

The trees were also examined for nymphs. Check trees on April 5 showed 350 aphides to 100 swollen fruit buds, while trees sprayed with lime-sulfur alone showed 25 aphides to 100 buds and the combination sprayed showed 10 aphides to 100 buds. It should also be observed that the lime-sulfur alone did not kill all the nymphs which had emerged at the time the spray was applied, while the combined lime-sulfur and nicotine did kill all the nymphs. Again, the combined spray demonstrated its superiority over lime-sulfur alone as a control measure for nymphs.

The above sprays were applied by means of one "Hardie" gun attached to a sprayer with 225-pounds pressure. The operator stood on the tank and sprayed the trees on each side of the row, thus giving each tree two applications from opposite directions. This type of instrument is very useful and well adapted to dormant spraying when it is necessary to hit all parts of the tree with considerable force.

On March 28 at J. L. Lippincott Company's orchard, at Riverton, N. J., a combination spray of lime-sulfur 1-9 and nicotine

1-500 was sprayed on some early varieties of apple trees (Star, etc.). The fruit buds on these trees were swollen and some were showing the tip ends of very small leaves. Twigs were collected and examined six hours after the spray was applied. The unsprayed twigs showed a 9.5 per cent hatch of all the eggs while the sprayed branches showed 6.3 per cent hatched. Comparing the percentage of hatch of these eggs with those collected near New Brunswick, it is evident that the majority of eggs hatched about 48 hours earlier. This is due to the fact that Riverton is approximately 50 miles south of New Brunswick. The above twigs were examined again after all the normal eggs had hatched (April 8) and the percentage of hatch in the check was 32 per cent, or an increase of 24.5 per cent, while the sprayed eggs showed 8.9 per cent hatched, or an increase of 2.6 per cent. On April 5 the orchard was examined for nymphs and the sprayed trees showed 17 nymphs to 100 fruit buds, while the buds of nearby unsprayed trees were in many cases completely covered with aphides. The above orchard experiment again shows the value of spraying eggs and nymphs at the hatching period with a combined spray consisting of lime-sulfur 1-9 and nicotine 1-500. The proportion of eggs which hatched after they were sprayed in this orchard was about 2 per cent higher than at John Barclay's orchard. This was probably due to the fact that the material was applied by using long rods and putting the material on in the form of a mist. Furthermore, an examination of the trees after the spray was applied showed a less thorough job than at Mr. Barclay's orchard. This difference is possibly due to the different types of instruments used in spraying the two orchards. Other orchards were carefully observed during the delayed dormant spray period and in all cases good results were obtained when the material was applied with extreme care.

After April 18 the decided value of applying a delayed dormant spray of lime-sulfur and nicotine for the control of aphides was not as conclusive this past season as in former seasons, because of the fact that a period of cold stormy weather accompanied by snow and sleet in most parts of the state occurred on April 9 and 10, and this weather killed a large percentage of the newly-hatched nymphs. In fact, some unsprayed orchards which had their swollen fruit buds covered with aphides on April 8 did not suffer from aphis attack after the stormy weather was past. During the past season, a large number of adult coccinellid beetles and larvæ of syrphid flies also were present in most orchards.

The time to apply the dormant spray is very important. As a general rule apply the dormant spray as late as possible, for at this time the greatest number of eggs are split and probably some are hatching, especially eggs of *A. avenæ*. The lime-sulfur can be applied with safety as the buds are swelling (plate 2, fig. B) and

first show green and until the small leaves project like small squirrel ears (plate 2, fig. C). When the young leaves have separated somewhat and appear as distinct structures, then the dormant strength of spray will burn them (plate 2, fig. D). The outline drawings of the twigs show the various stages of development of a fruit spur or terminal bud. Stage A is a dormant twig showing eggs of *A. pomi* scattered over its surface, stage B shows a slightly swollen terminal bud with eggs of *A. avenæ* about the dormant buds and nymphs of *A. avenæ* near the green exposed tip. Stage C is a more advanced stage of a swollen terminal bud and

Plate 2. Fruit buds in different stages of development.

is in the last stage when it is safe to apply a dormant lime-sulfur spray. Nymphs and eggs of *A. avenæ* are shown on this twig. Stage D shows distinct and well separated leaves. The nymphs of aphides, if present on such a twig, would be found to a considerable extent in between the leaves in protected places where it is next to impossible to hit all of them with a contact insecticide. Most varieties of apples with twigs in an advanced state cannot be sprayed with a dormant strength of lime-sulfur without injuring the young leaves. The length of the period from the time when the buds first show green and until they are too far advanced for dormant spray varies with the growing season. It may be less

than a week or more than ten days. In using a combination spray it would be better to apply the material thoroughly somewhat early than to wait too long, for as a rule weather conditions are very changeable during the latter part of March.

Other workers have had some experience with the combination spray. Wilson (24) in 1912 recommended for *A. pomi* and *A. sorbi:* "Spray in the spring just as the buds are opening with lime-sulfur plus 'Black-leaf 40' or 'Black-leaf 40' alone. Spray thoroughly applied at the time when the buds are opening will prevent 95-100 per cent of the aphis infestation. The lime-sulfur should be used winter-strength and the 'Black-leaf 40' added at the rate of 1 part to 900 parts of diluted lime-sulfur". Mr. Wilson does not indicate in his experiments whether the eggs have all hatched or not. In either case the combination will undoubtedly succeed, but nicotine sulfate alone at the strength of 1-900 would not kill many of the eggs, according to our experience.

During the spring of 1916 a number of experiments were conducted in various orchards in the state of New York by P. J. Parrott, H. E. Hodgkiss and F. H. Lathrop (18) with the use of lime-sulfur 1-8 plus ¾ pint of nicotine solution (40 per cent) to 100 gallons of solution. In these experiments, "the spraying was purposely delayed until the eggs had begun to hatch and it is reasonably certain that most of the nymphs had emerged." The results obtained in the various orchards were altogether satisfactory and they agree in large measure with those secured by various orchardists throughout New Jersey. The principal difference, however, is the fact that the eggs of *A. sorbi* had not started to hatch when the material was applied April 8, 1917, at Mr. Barclay's orchard; nevertheless they were killed. In the various experiments conducted in New York it is possible that some of the eggs had not hatched, for according to the authors' own statement they were only "reasonably certain that most of the nymphs had emerged." It may be possible to delay the "dormant spray" in New York orchards until the eggs of all species are hatched, but this is not the case in New Jersey, for the eggs of *A. pomi* and *A. sorbi* in two successive seasons, 1916 and 1917, did not hatch to any extent until the leaf buds had burst and the small leaves were well separated.

Dr. T. J. Headlee (9, 10) in 1916 carried on an extensive series of experiments against the rosy aphis at John H. Barclay's orchard and a brief summary of his data shows that the rosy aphis can best be destroyed by making a dormant treatment with lime-sulfur and following that with a green-bud treatment of "Black-leaf 40" (1-1000) plus soap (2 pounds to 50 gal.), or by delaying the dormant treatment of lime-sulfur until the buds begin to show green, and then applying it mixed with "Black-leaf 40" (1-500). These

results, so far as similar experiments are concerned, agree with those obtained by the author during 1917 and 1918.

Miscible Oils

A considerable amount of investigation has been conducted with various kinds of oils, commercial and otherwise, on the eggs of apple aphides. A number of workers have experimented with crude oil emulsions and miscible oils. The most recent work is by P. R. Jones (12), who in a preliminary report treats of various contact insecticides, but deals particularly with different oils as miscible oils, distillate oil emulsion, asphalt emulsion, crude oil emulsion, etc. His general conclusion in respect to these products is that oils having a specific gravity, 14°-29° Baumé, are much more effective in killing the eggs of aphides than high-gravity oils, 31°-41° Baumé. His recommendation reads, "As far as can be determined at present under western conditions it is believed that dormant treatment for eggs of the apple and purple aphides should be either commercial crude oil emulsion, 1-9 or 1-10 (where the concentrate contains 85 per cent crude oil); home-made crude oil emulsion, 19°-23° Baumé—and the application made as late in the winter as possible before the buds start to show green." He experimented with various miscible oils, some made from low-gravity oils and others from high-gravity oils, and so far as can be learned from his report the above conclusions pertaining to specific gravity of oils in general also hold for miscible oils. His results will be compared with those observed in this study.

No attempt was made by the author to carry on an extensive investigation with various oils, but two commercial miscible oils which are utilized extensively in New Jersey and other eastern states have been tried in a number of experiments, and their results carefully observed. The trade names for these oils are "Mechling's Scale-Oil", manufactured by Mechling Brothers Manufacturing Company, Camden, N. J., and "Scalecide", manufactured by B. G. Pratt Company, New York City. Both of these oils are largely made from oils which have a comparatively low specific gravity; the specific gravity and the information furnished by the two concerns confirms this statement. The specific gravity of "Mechling's Scale-Oil" used in the experiments was 28° Baumé at 65° F., and of "Scalecide" 25° Baumé at 65° F. The B. G. Pratt Company reports, "We use as a petroleum an asphaltum base oil from which the light inflammable and heavy lubricating oils have been removed and which has an oil gravity of about 26°-30° Baumé." The Mechling Brothers Manufacturing Company reports, 'Mechling's Scale-Oil is composed of three entirely different oils, a vegetable oil, a cresote oil and a paraffine oil, the largest part being the latter," and their guaranteed analysis shows 85-88 per cent mineral oil. The specific gravities of these two oils are

about the same, but if there is a difference "Mechling's Scale-Oil" is lighter than "Scalecide."

During March and April, 1917, a number of experiments were conducted with the above-mentioned miscible oils on the eggs of *A. avenæ* in the greenhouse and on the eggs of *A. avenæ, A. pomi* and *A. sorbi* out-of-doors at the laboratory. Also one experiment was conducted with "Scalecide" against the eggs of *A. avenæ* (*A. sorbi*, 15 per cent) at John H. Barclay's orchard. The results of the more important experiments with "Mechling's Scale-Oil and "Scalecide" are shown in table 4. Experiments G-27, 0-29 and 0-31 where "Mechling's Scale-Oil" was used at the rate of 1-19 showed a 6.3, 8.1 and 8.5 per cent hatch, respectively, while "Scalecide" 1-15, in experiments G-34, 0-36, 0-38 and 0-40, showed a 23.0, 34.6, 22.8, and 31.7 per cent hatch, respectively. In other words, three to four times as many eggs hatched when treated with "Scaleside" as with "Mechlings' Scale-Oil."

A comparison of the results obtained in the use of the two miscible oils shows that "Scalecide" 1-15 is not as effective in killing eggs as "Mechling's Scale-Oil" 1-19, and that neither may be depended upon to kill all the eggs or act as a satisfactory control when applied at the strengths recommended for dormant spray. Since both sprays are manufactured from low gravity oils it was impossible to explain the decided difference in the percentage of kill on the basis of the specific gravity of the oil, but it was apparent that some chemical might be present in one which did not occur in the other. In conjunction with the experiments with miscible oils, crude carbolic acid was used alone and in combination with the miscible oils, and it was noted that the eggs of all three species were highly susceptible to cresols and phenol; consequently, it was thought that the presence of these chemicals might explain the difference in the effectiveness of the two oils. In the first place, it was noted that "Mechling's Scale-Oil" had a distinct phenol odor, while this was not true of "Scalecide." The two oils were subjected to two qualitative tests (Landolt's and Lieberman's) (14, 22) for cresols and phenol. "Mechling's Scale-Oil" gave a decided test for cresols and phenol while "Scalecide" gave no indication. A short time after this the two companies kindly submitted an analysis of their respective products. And the manufactures of "Scalecide" definitely stated that their product contained no carbolic acid while Mechling Brothers' Manufacturing Company gave a guaranteed analysis of 4.5 to 6.5 per cent of phenol derivatives for "Mechling's Scale-Oil".

The presence of the phenol derivatives in "Mechling's Scale-Oil" and their absence in "Scalecide" probably accounts in large measure for the decided difference in the effectiveness of the two oils. In all the experiments G-28, 0-30, G-35, 0-37 and 0-39 (table

TABLE 9

Experiments With "Scalecide" and "Scalecide" Combined With Crude Carbolic Acid, Phenol c. p. and Cresol U. S. P. on Selected Eggs of A. Avenae (Out-of-doors, 1918)

Date sprayed and source of eggs	Feb. 1, 1918 Barclay's		Feb. 19, 1918 Barclay's		March 5, 1918 Lippincott's		March 14, 1918 Barclay's		March 20, 1918 Lippincott's		March 23, 1918 Barclay's	
Spray	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched
"Scalecide" 1-15	30 h 120	25.0	19 h 77	24.6	4 h 92	4.3	29 h 116	25.0	2 h 109	1.8	15 h 115	13.0
"Scalecide" 1-15, Crude Carbolic 1-99					1 h 97	1.0	2 h 127	1.5	0 h 102	0.0	0 h 104	0.0
"Scalecide" 1-15, Cresol 1-99			3 h 102	2.9	0 h 98	0.0	11 h 102	10.7	0 h 94	0.0	1 h 93	1.0
"Scalecide" 1-15, Phenol 1-99			17 h 98	17.3	13 h 84	15.4	43 h 113	38.0	2 h 102	2.0	4 h 90	4.4
"Scalecide" 1-40	18 h 81	22.2	26 h 102	25.4	7 h 94	7.4	27 h 88	30.8	8 h 102	7.8	39 h 102	38.2
"Scalecide" 1-40, Crude Carbolic 1-99					0 h 95	0.0	3 h 97	3.0	0 h 90	0.0	1 h 99	1.0
"Scalecide" 1-40, Cresol 1-99	27 h 81	33.3	3 h 112	2.6	1 h 98	1.0	7 h 110	6.5	0 h 95	0.0	3 h 110	2.7
"Scalecide" 1-40, Phenol 1-99	10 h 59	17.0	23 h 123	18.5	10 h 101	10.0	35 h 102	34.3	9 h 100	9.0	13 h 104	12.5
Check	120 h 175	68.5	80 h 150	53.3	45 h 135	33.3	97 h 212	45.7	89 h 201	44.2	34 h 104	32.6

h—indicates hatched eggs

4) where crude carbolic acid was added at the rate of 2 parts to 98 of miscible oil spray (making a 2 per cent solution), the percentage of hatched eggs was decreased to 3.9 per cent or a complete kill where "Scalecide" 1-15 was used, and all eggs were killed when the acid was added to "Mechling's Scale-Oil". These results show that miscible oils would be much more effective in killing aphid eggs if crude carbolic acid (principally cresol) derivatives were present.

Comparing the results of the experiment where two heavy miscible oils were used with those obtained by P. R. Jones (12), there is some disagreement. "Scalecide" is unquestionably a low gravity oil and it was used at the same rate as Miscible Oil No. 1, which gave good results in California. This apparent inconsistency in results cannot be explained on the basis of specific gravity, so the question is raised in respect to the presence of phenol or cresols in Miscible Oil No. 1, and also whether these active antiseptic agents were present in the various oils used in the western states where good results were obtained. It is thought that the presence of these chemicals may prove to be far more important than the mere specific gravity of the oil. Possibly one can add crude carbolic acid to oils in general and increase their insecticidal value.

In 1918 a number of experiments were conducted during February and March with "Scalecide" at varying strengths and in combination with crude carbolic acid, cresol U. S. P., and phenol c. p. on the eggs of *A. avenæ* out-of-doors at the laboratory. The purpose of these experiments was to determine what material in crude carbolic acid is the most effective agent in killing aphid eggs and how much acid should be added to a miscible oil in order that it might kill 100 per cent of all the eggs with which it came in contact. "Scalecide" was chosen as a favorable oil, for chemical tests show that there was little or no carbolic acid of phenol derivatives present in it. Table 9 shows in condensed form the results of these experiments. In the left-hand column the treatments of the series are given, and at the top the date of the spraying and the orchard from which the eggs were collected. In the two spaces for each experiment there are shown the number of hatched eggs (h), the total number of eggs used, and the percentage of hatch.

The results of the experiments with "Scalecide" show considerable variation in the respective series, more so than in any other series of experiments with other sprays. These somewhat inconsistent results are not understood; however, if one studies the table it is seen that the eggs are most susceptible to "Scalecide" (alone or in combination with the acids) near the time when the nymph emerges, or in other words, when the greatest number of eggs show a split outer covering. "Scalecide" 1-15 is more effective

than "Scalecide" 1-40 but when crude carbolic acid or cresol is combined with these two strengths the difference between the results is not as marked. Crude carbolic acid (100 per cent acid), 1 part to 99 parts of spray, combined with "Scalecide" 1-15 makes the most effective (100 per cent) kill and also the cheapest killing agent of the three acid combinations tried out. Combinations with cresol U. S. P. are almost as effective as crude carbolic but combinations with phenol c. p. are the least effective and also the most expensive.

TABLE 10

EXPERIMENTS WITH "SCALECIDE" COMBINED WITH CRESOL* ON SELECTED EGGS OF A. AVENAE COLLECTED FROM J. L. LIPPINCOTT AND COMPANY; OUT-OF-DOORS; SPRAYED MARCH 26, 1918

Number of Experiment	Spray	Total Eggs	Total Hatch	Percentage Hatched
331	Check	106	57	53.7
332	"Scalecide" 1-15	106	9	8.4
333	"Scalecide" 1-15, plus cresol 0.5%	75	2	2.6
334	"Scalecide" 1-15, plus cresol 1%	85	0	0.0
335	"Scalecide" 1-15, plus cresol 1.5%	82	0	0.0
336	"Scalecide" 1-25	112	16	14.2
337	"Scalecide" 1-25, plus cresol 0.5%	83	2	2.4
338	"Scalecide" 1-25, plus cresol 1%	91	3	3.3
339	"Scalecide" 1-25, plus cresol 1.5%	90	1	1.1
340	"Scalecide" 1-40	88	7	7.9
341	"Scalecide" 1-40, plus cresol 0.5%	93	2	2.1
342	"Scalecide" 1-40, plus cresol 1%	93	1	1.0
343	"Scalecide" 1-40, plus cresol 1.5%	103	0	0.0

*The cresol was composed of one part meta-cresol, one part ortho-cresol and one part para-cresol.

Another set of experiments, shown in table 10, were conducted on March 26, 1918 with "Scalecide" 1-15, 1-25 and 1-40 alone and each in combination with 0.5, 1.0 and 1.5 per cent cresol. The cresol mixture was made up of one part meta cresol, one part ortho cresol and one part para cresol. These experiments show again a decided increase in the effectiveness of the "Scalecide" when cresol is added. In all cases the 1.5 per cent cresol combinations showed the smallest percentage of hatch, in two experiments a complete kill. The experiments also show that the percentage of hatch in the various strengths of "Scalecide" (alone) varies more than when the same strength of "Scalecide" has a given amount of cresol added to it. In other words, the strength of the oil when in combinations with cresol is not as important as the strength of the cresol. This same thing holds true for crude carbolic when combined with a miscible oil.

Comparing these foregoing experiments with miscible oils and others of a similar nature conducted this past season with those of 1917, it is evident that a miscible oil spray needs to possess 1.5 to 2.0 per cent crude carbolic acid or cresol as it goes on the tree in

order to kill all the eggs of *A. avenæ*. Eggs of *A. pomi* and *A. sorbi* also respond in a similar manner to combinations of "Scalecide" and crude carbolic acid; however, they are apparently somewhat more resistant, and consequently more will hatch.

In the orchard "Scalecide" 1-15 was given a trial at John H. Barclay's place in 1917 in conjunction with a combined spray of lime-sulfur 1-9 and "Black-leaf 40" 1-500. During the morning of April 7, Mr. Barclay sprayed 100 large apple trees with "Scalecide" 1-15. The buds were swollen and some of the leaves were out about ¼ inch. These trees at the time of spraying averaged five nymphs of *A. avenæ* per bud. A careful examination was made of several hundred buds at 5 o'clock the afternoon of the same day, and at this time the nymphs averaged 1 living aphid to 25 buds; in other words, the "Scalecide" killed 99 per cent of the nymphs. These trees were again examined on April 14 when the leaves were out ½ to ¾ inch long, and at this time the nymphs averaged one to every two buds, but these were mostly nymphs of *A. sorbi*. Out-of-door laboratory experiments conducted during this period showed that all eggs of *A. avenæ* had hatched by April 6 or 7, and the eggs of *A. sorbi* commenced to hatch about April 12. According to these data the eggs of *A. sorbi* hatched after April 7, and "Scalecide" did not prevent all the eggs of this species from hatching. In fact, the infestation was severe enough to demand the use of "Black-leaf 40" 1-500 when the lime-sulfur 1-40 was applied at the pink-bud stage. Even though this measure of precaution was taken the results were by no means satisfactory.

In contrast to the above experiment, lime-sulfur 1-9 plus "Black-leaf 40" 1-500 was applied to about one hundred infested trees (5 nymphs to the bud) on April 7, and an examination made in the afternoon of the same day showed that so many of the nymphs had been killed that none could be found. A vast majority of the eggs of *A. sorbi* also were killed, for no nymphs could be found on April 14; however, a very few did survive, for in the latter part of May and in June an occasional tree showed a few clusters of leaves infested with *A. sorbi*, but the majority of the trees were entirely clean. The trees treated with "Scalecide" on April 7 and later sprayed with lime-sulfur 1-40 plus "Black-leaf 40" showed during May and June a comparatively heavy infestation. No tree was completely free and in many a considerable amount of fruit was damaged. One tree which had received no dormant treatment or nicotine sulfate served as a check, and this tree was severely infested, over 75 per cent of the leaves being badly curled and a large percentage of the fruit ruined. These experiments, along with those conducted at the laboratory, show the superiority of lime-sulfur 1-8 or 1-9, plus "Black-leaf 40"

1-500 over "Scalecide" 1-15 for the control of aphids in the nymph and egg stage. They also bring out the fact that a most careful attempt to "clean up" aphis by adding 40 per cent nicotine to summer strength lime-sulfur at the cluster-cup or pink-bud stage will at times fail.

A few young trees not over six years old were sprayed with "Scalecide" 1-15 plus crude carbolic acid, 1 part to 99 of the spray (1 per cent solution), on March 18, 1918. These were carefully observed at the time the leaves came out. On most of the branches of the sprayed trees the leaves appeared to be normal, but on a few of the lower branches the buds were backward in opening and some seemed to be dead. Before the combination of "Scalecide" and crude carbolic acid can be recommended as a dormant spray for killing aphid eggs, it will be necessary to give this combination a thorough trial and note its effect upon various varieties of apple trees.

Soaps

Common laundry soap, commercially called "Fels Naptha", and fish-oil soaps (made from commercial liquid and solid forms) were used chiefly as spreaders in a large number of experiments with nicotine, crude carbolic acid, phenol c. p., cresol U. S. P., meta cresol c. p., ortho cresol c. p., para cresol c. p., etc. In all these experiments the soap was always given a separate trial in order to determine its influence on the percentage of hatch. Besides using laundry soap as a spreader, a large number of experiments were conducted with different concentrations of fish-oil soap (made from both solid and liquid forms) and resin fish-oil soap on the eggs of *A. avena* in out-of-door experiments throughout February and March, 1918. In the majority of experiments (tables 4 etc.) where the soaps were used at the rate of 1 gm. to 200 cc. (1 pound to 24 gallons) there was a slight reduction in the percentage of hatch. This can be seen by comparing the percentage of hatch among the sprayed eggs with the respective checks. Even though this reduction was small it demonstrates the fact that some of the eggs of each species are much less resistant than others.

A limited number of experiments were conducted in 1917 with fish-oil soap (exp. G-61 to G-63 and 0-64 to 0-67, table 4) and the results indicated that this soap was very effective when in concentrated form. The results of these experiments, however, were questioned, for unfortunately they were dislodged by a heavy wind and covered with snow for two days before the accident was discovered. In spite of this unfortunate occurrence, these experiments and others indicated that it would be advisable to make an extensive study of the effect of different strengths of fish-oil soap on the

TABLE 11

EXPERIMENTS WITH FISH-OIL SOAP SPRAYS (MADE FROM SOLID AND LIQUID FORMS) ON SELECTED EGGS OF A. AVENAE; OUT-OF-DOORS, 1918

Date Sprayed and Source of Eggs	Feb. 19, 1918 Barclay's		Mar. 4, 1918 Lippincott's		March 14, 1918 Barclay's		March 19, 1918 Lippincott's		March 22, 1918 Barclay's	
Spray	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched
Check	80 h 150	53.3	45 h 135	33.3	97 h 212	45.7	89 h 201	44.2	34 h 104	32.6
Fish-Oil Soap (solid) 1 gm.-200 cc.	14 h 106	62.7	25 h 89	28.0	40 h 97	41.2	42 h 82	51.2	18 h 103	17.4
Fish-Oil Soap (solid) 1 gm.-100 cc.			47 h 131	35.8	34 h 92	36.9	31 h 78	39.7	23 h 102	22.5
Fish-Oil Soap (solid) 1 gm.-50 cc.	54 h 111	48.6	27 h 107	25.2	23 h 100	23.3	53 h 105	50.4	14 h 90	15.5
Fish-Oil Soap (solid) 1 gm.-25 cc.	31 h 89	34.8			19 h 105	18.1			7 h 97	7.2
Fish-Oil Soap (liquid) 1 cc-200 cc.	47 h 101	46.8			45 h 102	44.1			35 h 107	32.7
Fish-Oil Soap (liquid) 1 cc-50 cc.	27 h 94	28.7			53 h 125	42.4	67 h 112	59.8	28 h 101	27.8
Fish-Oil Soap (liquid) 1 cc-25 cc.	59 h 115	51.3			40 h 105	38.0	42 h 91	46.1	31 h 127	24.4
Fish-Oil Soap (liquid) 1 cc-10 cc.							28 h 92	30.4	20 h 108	18.5

h—indicates hatched eggs.

TABLE 12

Experiments With Resin Fish-Oil Soap on Selected Eggs of A. Avenae, Out-of-Doors, 1918

Date sprayed and Source of Eggs	Feb. 1, 1918 Barclay's		Feb. 19, 1918 Barclay's		March 4, 1918 Lippincott's		March 14, 1918 Barclay's		March 22, 1918 Barclay's	
Spray	Hatched and Total Eggs	Percentage Hatched	Hatched Eggs and Total	Percentage Hatched	Hatched and Total Eggs	Percent-Hatched age	Hatched and Total Eggs	Percent-Hatched age	Hatched and Total Eggs	Percentage Hatched
Resin fish-oil soap 1 gm.-200 cc.	25 h 85	28.0	54 h 108	50.0	38 h 94	39.5	57 h 118	48.3	46 h 117	39.3
Resin fish-oil soap 1 gm.-100 cc.	32 h 82	39.0			33 h 90	36.6	56 h 93	60.2	52 h 120	43.3
Resin fish-oil soap 1 gm.-50 cc.	35 h 67	52.2	43 h 89	48.3	44 h 92	47.7	23 h 85	27.0	23 h 100	23.0
Resin fish-oil soap 1 gm.-25 cc	25 h 75	33.3	41 h 94	43.5			17 h 54	31.4	19 h 128	14.8
Check	78 h 173	45.0	80 h 150	53.3	45 h 135	33.3	97 h 212	45.7	34 h 104	32.6

h—indicates hatched eggs

eggs of apple aphides, consequently a large number of experiments were conducted with varying concentrations of fish-oil soap sprays (made from solid and liquid soaps) and resin fish-oil soap on the eggs of *A. avenæ* out-of-doors at the laboratory during February and March, 1918. The results of these experiments are given in the usual manner in tables 11 and 12.

These experiments recorded in table 11 and others of a similar nature show that fish-oil soap sprays made from either the solid or liquid form are quite effective in killing aphid eggs. Similar concentrations of laundry soap are not as effective as the fish-oil soaps. Comparing the effectiveness of the same concentration of fish-oil soap sprays made from solid and liquid fish-oil soap, the percentage of hatch was much less where the fish-oil soap spray was made from solid fish-oil soap.[2]

Resin fish-oil soap (table 12) was also given a thorough trial in a set of experiments similar to the above, and the results of the experiments show that resin fish-oil soap is not as effective in killing eggs as the same concentration (by weight) of fish-oil soap sprays made from solid fish-oil soap. The lowest percentage of hatch with resin fish-oil soap, 1 gm. to 25 cc., applied on March 22, was 14.8 per cent, while a similar concentration of fish-oil soap made from solid soap reduced the percentage of hatch to 7.2 per cent when applied on the same day.

All the series of experiments (soap of same concentration) with the various soaps show the greatest percentage of kill or the smallest percentage of hatch when the spray was applied near the time when the nymph emerges. In other words, the exposed pigmented layer of the eggs is more pervious to soap solutions than the outer tough layer. This observation again substantiates a former statement made in discussing contact insecticides; when the greatest number of eggs show a split-out shell, then the greatest number of eggs will be most susceptible to various contact insecticides. The greatest number of eggs with a split outer covering occurs at the time when the first nymphs emerge.

NICOTINE

A number of experiments have been conducted with nicotine as found in the commercial products called "Black-leaf 40" and "Nicotine resinate" (40 per cent nicotine in each). These are manufactured by the Kentucky Tobacco Products Company, Louisville, Ky. In 1917 the "Black-leaf 40" was applied on the eggs of *A. avenæ* out-of-doors at the laboratory on April 3 (exp. 0-41

[2]The solid and liquid fish-oil soaps were purchased from Capstone Manufacturing Co., Newark, N. J., and the resin fish-oil soap from James Good, Philadelphia, Pa.

TABLE 13

EXPERIMENTS WITH NICOTINE, "BLACK-LEAF 40", COMBINED WITH FISH-OIL SOAP (solid) AND NICOTINE RESINATE ON SELECTED EGGS OF A. AVENAE; OUT-OF-DOORS, 1918

Date Sprayed and Source of Eggs	Feb. 19, 1918 Barclay's		Mar. 4, 1918 Lippincott's		Mar. 14, 1918 Barclay's		Mar. 19, 1918 Lippincott's		Mar. 22, 1918 Barclay's	
Spray	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched
"Black-leaf 40" 1-500, F. O. soap (s) 1 gm.-200 cc.	41 h 96	42.7	28 h 108	25.9	46 h 107	42.9	32 h 98	32.6	24 h 103	23.3
"Black-leaf 40" 1-500, F. O. soap (s) 1 gm.-100 cc.			16 h 96	16.6	37 h 124	29.8	14 h 91	15.3	9 h 94	8.5
"Black-leaf 40" 1-500, F. O. soap (s) 1 gm.-50 cc.	17 h 60	28.3	9 h 101	9.0	15 h 145	10.3	4 h 92	4.3	0 h 107	0.0
"Black-leaf 40" 1-500, F. O. soap (s) 1 gm.-25 cc.	14 h 106	13.2			2 h 108	1.8			0 h 119	0.0
Nicotine resinate 1 cc.-1000 cc.	50 h 103	48.5	42 h 121	34.7	25 h 110	22.7	22 h 81	27.1	26 h 110	23.6
Nicotine resinate 1 cc.-500 cc.	46 h 93	49.4	31 h 105	29.5	20 h 112	17.8	9 h 94	12.1	17 h 146	11.6
Nicotine resinate 1 cc.-250 cc.	30 h 104	28.8			18 h 82	21.9			6 h 110	5.4
Check	80 h 150	53.3	45 h 135	33.3	97 h 212	45.7	89 h 201	44.2	34 h 104	32.6

h—indicates hatched eggs; s—indicates solid fish-oil soap.

to 0-44, table 4) at the rate of 1-100, 1-250 and 1-500, and laundry soap (1 gm. to 200 cc.) was used as a spreader. The percentages of hatch in the check and in the experiment where the laundry soap was tried alone were approximately the same, 40 per cent and 39.2 per cent, respectively; consequently the soap must have had very little effect on the percentage of hatch when combined with the nicotine. The percentage of hatched eggs was reduced in all the experiments with the nicotine. Where the nicotine was used at the rate of 1-500 the percentage of hatch was 22.4 per cent, or 17.6 per cent lower than in the check. The greater strengths of nicotine showed a still greater reduction. According to the above experiment with "Black-leaf 40" 1-500, when combined with enough laundry soap to act as a spreader, the reduction in the number of hatched eggs is not sufficient to warrant the use of the same as a control measure. Greater strengths than 1-500 are prohibitive on account of the cost.

During the dormant season of 1917-18 a number of experiments were conducted with "Black-leaf 40" combined with lime-sulfur 1-9, fish-oil soap and resin fish-oil soap. In all but one or two of these experiments the combined spray was considerably more effective than the lime-sulfur, fish-oil soap, or resin fish-oil soap alone. This was particularly true when the combined spray was applied near the time when the nymph emerges, or in other words, when the greatest number of eggs show a split outer shell. The superiority of a combined nicotine and lime-sulfur spray over lime-sulfur alone has been considered under the discussion on lime-sulfur.

The experiments with the combinations of "Black-leaf 40", and fish-oil soap sprays made from solid soap show the greatest percentage of kill, 100 per cent, where the "Black-leaf 40" 1-500 was combined with fish-oil soap, 1 gm. to 50 cc. (= 1 pound to 6 gallons), or 1 gm. to 25 cc. (= 1 pound to 3 gallons), and sprayed on the eggs of *A. avenæ* as they started to emerge, March 22. Fish-oil soap alone at the same respective strengths and applied on the same day killed only 85 and 92 per cent of the eggs. A comparison of the results in the two tables (11 and 13) shows the relative superiority of a combined spray of nicotine and fish-oil soap over fish-oil soap alone.

A number of experiments were conducted also with nicotine combined with fish-oil soap sprays made from liquid fish-oil soap, and with similar concentrations (by weight) the percentage of kill was not as great as with fish-oil soap made from solid soap. This is undoubtedly due to the fact that commercial liquid fish-oil soap possesses a considerable portion of water (60-70 per cent); consequently, there is not as much soap present when diluted to the desired strength.

A few experiments were conducted with combinations of nicotine and resin fish-oil soap, and these indicate that resin fish-oil soap is not as effective in combination with nicotine as fish-oil soap made from solid soap.

Nicotine resinate, containing 40 per cent nicotine, was also given a thorough trial during February and March, 1918, on the eggs of *A. avenæ* out-of-doors at the laboratory (table 13). This material behaves like a soap solution and has good spreading and lasting qualities. Nicotine resinate is more effective in killing aphid eggs than "Black-leaf 40" combined with weak solutions of laundry soap. Nicotine resinate at the rate of 1-500 killed 88.4 per cent when the material was applied on March 22, while the same amount of nicotine in "Black-leaf 40" combined with fish-oil soap (solid form), 1 gm. to 50 cc. killed 100 per cent (0.0 per cent hatched).

All the experiments where nicotine is used show that some eggs are killed with nicotine and where nicotine is combined with lime-sulfur, fish-oil soaps, resin fish-oil soap and resin (nicotine resinate) the percentage of kill is increased, and in a few experiments no eggs survived. The experiments also show that the greatest number of eggs of *A. avenæ* are most susceptible to nicotine during the latter part of March, or in other words, when the largest number of eggs show a split outer covering. This brings out the significant relationship between the time of application of the spray, the behavior and structure of the outer semi-transparent layer of the egg, and the susceptibility of the eggs to certain contact insecticides.

Crude Carbolic Acid, Phenol and Cresols

During the past two seasons a large number of experiments were conducted with eggs on twigs in the greenhouse, out-of-doors at the laboratory and on young apple trees in the orchard with crude carbolic acid, phenol c. p. cresol U. S. P., meta cresol c. p., ortho cresol c. p., and para cresol c. p. The eggs of all three species of aphides were experimented with in 1917, but only those of *A. avenæ* were obtainable during the past dormant season (1917-18). The results of the following experiments recorded in the various tables show that crude carbolic acid gives some promise of becoming an important substance for the control of aphides in the egg stage, provided it is applied when the tree is dormant.

During March and April, 1917, crude carbolic acid only was used and not any of the pure cresols or phenol. The crude acid had a dark brown color and was approximately 100 per cent acid (no water). It was purchased from Eimer and Amend, New York City, at 60 cents per gallon (ante bellum price). According to Merck and Company, Manufacturing Chemists, this crude carbolic

TABLE 14

EXPERIMENTS WITH CRUDE CARBOLIC ACID, CRESOL U. S. P., PHENOL c. p., META CRESOL c. p., ORTHO CRESOL c. p., AND PARA CRESOL c. p., ON SELECTED EGGS OF A. AVENAE; LAUNDRY SOAP USED AS A SPREADER; OUT-OF-DOORS, 1918

Date Sprayed and Source of Eggs	Dec. 25, 1917 Barclay's		Feb. 23, 1918 Barclay's		Mar. 5, 1918 Lippincott's		Mar. 13, 1918 Barclay's		Mar. 25, 1918 Barclay's	
Spray	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched
Check	120 h 175	68.5	99 h 202	49.0	45 h 135	33.3	116 h 241	48.1	57 h 123	46.3
Laundry Soap (Fels Naptha) 1 gm. to 200 cc.	51 h 92	55.4	42 h 81	51.8	52 h 100	52.0	47 h 110	42.7	32 h 77	44.4
Crude Carbolic, 1%, Laundry soap, 1 gm.-200 cc.					26 h 99	26.2	73 h 106	68.2	11 h 100	11.0
Cresol U. S. P., 1%, Laundry soap, 1 gm.-200 cc.	82 h 125	65.6	41 h 103	39.8	39 h 107	36.4	31 h 112	27.6	33 h 103	32.0
Phenol c. p., 1%, Laundry soap, 1 gm.-200 cc.	55 h 94	58.5	31 h 96	32.2	21 h 83	25.3	53 h 77	68.8	32 h 99	32.4
Meta cresol c. p., 1%, Laundry soap, 1 gm.-200 cc.			53 h 98	54.0	18 h 89	20.2	49 h 101	49.0	31 h 105	29.5
Ortho cresol c. p., 1%, Laundry soap, 1 gm.-200 cc.	48 h 109	44.0	23 h 109	21.1	28 h 98	28.5	60 h 111	54.0	30 h 103	29.1
Para cresol c. p., 1%, Laundry soap, 1 gm.-200 cc.	48 h 93	48.3	36 h 104	34.6	18 h 85	21.1	59 h 116	50.8	26 h 100	26.0

h—indicates hatched eggs.

consisted chiefly of the three isomeric cresols and possibly some xylenol and higher homologues. The crude form used in the following experiments may have also contained some phenol. No quantitative tests were made of this acid, but the extensive experiments conducted with pure phenols and with all three isomeric cresols during 1918 show the relative value of each constituent of crude carbolic acid in respect to killing aphid eggs. The crude carbolic acid at varying strengths, 0.5, 1, 2, 5 and 10 per cent, was used in experiments G-46 to G-51 and 0-52 to 0-58 (table 4) and in all cases a small quantity of soap was used as a spreader. These experiments show an increase in the effectiveness of the spray as the strengths of the acid was increased. Strengths less than 2 per cent acid did not kill a sufficient number of eggs to be considered effective, while strengths greater than 2 per cent acid killed all eggs, and a 2 per cent acid spray killed 96 to 100 per cent. Some experiments where a small amount of fish-oil soap was used as a spreader also were tried with varying strengths of crude carbolic acid, and the results obtained were similar to the foregoing experiments.

In combining crude carbolic acid with soap solutions, it was noted that the crude acid mixes more readily with a fish-oil soap solution than with a laundry soap ("Fels Naptha") solution, and also when thoroughly mixed with a fish-oil soap solution it will remain constant throughout for a considerable period. In preparing mixtures of crude carbolic acid and soap solutions it was advantageous to mix the acid thoroughly with two or three times its volume of soapy water, and then make the desired dilution. Fish-oil soap is also superior to laundry soap in that it has greater insecticidal properties.

The results of the experiments for 1917 indicated that it would be worth while to make a similar but more extensive study of the various isomeric cresols and phenol which go to make crude carbolic acid and note the effect of each on the eggs of aphides. This was undertaken during the past season, with crude carbolic acid, cresols and phenol at varying strengths and in combinations with different strengths of fish-oil soap, such as solid fish-oil soap, liquid fish-oil soap and resin fish-oil soap.

In the first place, a number of experiments were conducted from December 15 to March 25, 1918, with a 1 per cent solution (1 part to 99 of soapy water) of crude carbolic acid, phenol c. p., cresol U. S. P., meta cresol c. p., ortho cresol c. p., and para cresol c. p.; laundry soap ("Fels Naptha") being used at the rate of 1 gm. to 200 cc. The purpose of these experiments was to determine the relative killing effect of the various acids on the eggs of *A. avenæ*. The experiments show that the soap solution alone had little or no effect upon eggs, for the percentage of hatch in the

TABLE 15

EXPERIMENTS WITH CRUDE CARBOLIC ACID, CRESOL U. S. P., AND PHENOL c. p., COMBINED WITH DIFFERENT STRENGTHS OF FISH-OIL SOAP (solid soap) ON SELECTED EGGS OF A. AVENAE; OUT-OF-DOORS, 1918

Date Sprayed and Source of Eggs	Mar. 1, 1918 Barclay's		Mar. 5, 1918 Lippincott's		Mar. 14, 1918 Barclay's		Mar. 23, 1918 Barclay's	
Spray	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched	Hatched and Total Eggs	Percentage Hatched
Check	99 h 202	49.0	45 h 135	33.3	97 h 212	45.7	57 h 123	46.3
Fish-Oil Soap (solid), 1 gm.-100 cc.			47 h 131	35.8	34 h 92	36.9	23 h 102	22.5
Crude Carbolic, 0.5%, Fish-Oil Soap 1-100	51 h 127	40.1	33 h 86	38.3	29 h 107	27.1	8 h 113	7.0
Crude Carbolic, 1%, Fish-Oil Soap 1-100	37 h 138	26.8	14 h 104	13.4	19 h 112	16.9	13 h 111	11.7
Crude Carbolic, 1.5%, Fish-Oil Soap 1-100	22 h 125*	17.6			13 h 114	11.4	4 h 117	3.4
Cresol U. S. P., 0.5%, Fish-Oil Soap 1-100	48 h 119	40.3	24 h 105	22.8	30 h 111	27.0	16 h 108	15.1
Cresol U. S. P., 1%, Fish-Oil Soap 1-100	49 h 107	45.7	22 h 105	20.9	24 h 119	20.1	10 h 106	9.4
Cresol U. S. P., 1.5%, Fish-Oil Soap 1-100	52 h 133*	39.8			9 h 110	8.1	9 h 109	8.2
Phenol c. p., 0.5%, Fish-Oil Soap 1-100	64 h 138	46.3	36 h 115	31.3	32 h 95	33.6	40 h 112	35.7
Phenol c. p., 1%, Fish-Oil Soap 1-100	42 h 126	33.3	36 h 104	34.5	27 h 105	25.7	24 h 91	26.3

Phenol c. p., 1.5%, Fish-Oil Soap 1-100	41 h 121*	33.8			14 h 101	14.0	12 h 105	11.4
Fish-Oil Soap (solid), 1 gm.-50 cc.	54 h 111	48.6	27 h 107	25.2	23 h 100	23.0	14 h 90	15.5
Crude Carbolic, 0.5%, Fish-Oil Soap 1-50	37 h 131	28.2	25 h 116	21.5	39 h 126	30.9	4 h 121	3.3
Crude Carbolic, 1%, Fish-Oil Soap 1-50	35 h 120	29.1	15 h 117	11.9	23 h 115	20.0	4 h 136	3.7
Crude Carbolic, 1.5%, Fish-Oil Soap 1-50	18 h 126*	14.2			25 h 100	23.8	0 h 138	0.0
Cresol U. S. P., 0.5%, Fish-Oil Soap 1-50	52 h 124	41.9	20 h 96	20.8	15 h 65	23.0	14 h 96	14.3
Cresol U. S. P., 1%, Fish-Oil Soap 1-50	41 h 138	29.7	37 h 98	37.7	37 h 113	32.7	12 h 112	10.7
Cresol U. S. P., 1.5%, Fish-Oil Soap 1-50	28 h 100*	28.0			25 h 81	30.9	11 h 114	9.6
Phenol c. p., 0.5%, Fish-Oil Soap 1-50	25 h 166	23.4	15 h 105	14.2	16 h 74	21.6	28 h 112	25.0
Phenol c. p., 1%, Fish-Oil Soap 1-50	30 h 114	26.2	42 h 111	37.8	18 h 103	17.4	11 h 106	10.3
Phenol c. p., 1.5%, Fish-Oil Soap 1-50	42 h 128*	32.6			33 h 140	23.5	12 h 116	10.3

h—indicates hatched eggs.
*In these experiments the crude carbolic acid, cresol or phenol was 2.5 per cent by mistake.

various checks corresponds with the percentage of hatch where the laundry soap was used at the rate of 1 gm. to 200 cc.

The results of the experiments with a 1 per cent solution of the various acids are not very conclusive, and they are also somewhat inconsistent. This is probably due to the fact that a 1 per cent solution is not strong enough to produce an appreciable amount of actual kill, especially when applied early in the season. A 2 per cent solution probably would have given better results, at least the experiments conducted in 1917 indicate as much. Even though the 1 per cent solution did not produce a great amount of kill, nevertheless the smallest percentage of hatched eggs occurred when the spray was applied in the latter part of March near the time when the nymphs emerge.

In order to determine the effectiveness of the varying strengths of crude carbolic acid, cresol U. S. P., and phenol C. P. with fish-oil soap, a large number of experiments were conducted out-of-doors at the laboratory throughout the month of March, 1918. The acids were used in three different strengths 0.5, 1, and 1.5 per cent, and the fish-oil soap solutions (made from solid soap) in two strengths: 1 gm. to 100 cc. (= 1 pound to 12 gallons) and 1 gm. to 50 cc. (= 1 pound to 6 gallons). All possible combinations were made between the three strengths of each acid and the two strengths of the fish-oil soap. Table 15 shows in condensed form, similar to foregoing tables, the treatment given, time of application, source of the eggs, number of hatched eggs (h), total number of eggs and the percentage of hatch.

A general survey of the results of the experiments in table 15 again brings out the point that a contact insecticide applied late in March just before the nymphs emerge will kill the greatest number of eggs. In the four trials with each strength of acid on March 1, 5, 14 and 23 the smallest percentage of hatch occurred where the applications were made on March 14 and 23, and in most cases when applied on March 23. These results indicate that the acid can more readily penetrate to the embryo through the pigmented layer alone (after the outer shell splits) than through both layers when the outer covering is whole. The greatest number of eggs showed a split outer covering on March 23.

A comparison of the effectiveness of the three acids at similar strengths shows that crude carbolic acid killed the largest percentage and phenol the least while cresol U. S. P. was almost as effective in some experiments as crude carbolic acid. A comparison of all the experiments, where the acids composed 1.5 per cent of the spray, brings out the respective effectiveness of the three acids. Why the crude carbolic acid should be the most effective is un-

known. The greatest strength, 1.5 per cent, of the three was the most effective. Furthermore, whenever the same strength of one acid was used with the two different strengths of fish-oil soap the greatest percentage of kill took place when the stronger fish-oil soap, 1 gm. to 50 cc., was used.

If all the above facts are consistent throughout then the one experiment where crude carbolic acid composed 1.5 per cent of the spray combined with a fish-oil soap solution, 1 gm. to 50 cc., and applied on March 23, should show the smallest percentage of hatch. This is the actual case, for the experiment, which fulfills the above requirements, is the only one in the entire lot which shows no hatch, or 100 per cent kill. All other experiments showed some hatch. If the above requirements were fulfilled in orchard spraying it would be possible to control the aphis with this spray. These experiments and others not shown in this paper indicate that a 2 per cent solution of crude carbolic acid combined with a strong fish-oil soap solution would come nearer to controlling aphides in the stage than a 1 or 1.5 per cent acid solution.

A somewhat similar series of experiments (not shown in the table form) were conducted with crude carbolic acid, cresol U. S. P., and phenol c. p., combined with fish-oil soap solution which had been made from liquid fish-oil soap. In these experiments the effectiveness of the combination between the acid and the fish-oil soap was decreased as the strength of the fish-oil soap was increased. This apparent inconsistency was probably due to the fact that the liquid fish-oil soap is strongly basic, and this basic condition of the soap neutralized the acid as its strength was increased.

Similar combinations between the three acids and resin fish-oil soap were tried, but these were not extensive enough to warrant a conclusive statement concerning their effectiveness. A comparison of these results with combinations of the acids and fish-oil soap solutions made from solid fish-oil soap showed that the effectiveness of the combinations between the acids and the resin fish-oil soap was somewhat less than when the acids were combined with fish-oil soap solutions made from solid soap.

The effect of crude carbolic acid on various fruit trees during the dormant season has never been determined, so far as is known; consequently it was necessary to conduct some preliminary experiments along this line. Six apple trees were experimented on, one old tree and five 6-year-old trees. On April 2, 1917, two of the 6-year-old trees and a portion of the mature tree were sprayed with a 2 per cent solution of crude carbolic acid plus laundry soap at the rate of 1 pound to 24 gallons of water. During the same day two 6-year-old trees were sprayed with a 5 per cent solution of crude carbolic acid with laundry soap as a spreader. One 6-year-

old tree and the unsprayed portion of the old tree served as checks. Frequent observations were made of these trees during the period between the bursting of the leaf and the fruit buds and to full blossom and, so far as could be observed, no injury was found on any of the trees. Similar experiments were conducted on March 18, 1918, with fish-oil soap, 1 pound to 6 gallons of water, plus cresol U. S. P. 2 per cent (2 parts to 98 of solution), and again no injury could be detected. On the basis of the above experiments, apparently one can safely apply on dormant trees a spray composed of 2 per cent crude carbolic acid plus fish-oil soap.

VARIOUS CHEMICALS

Sodium sulfo-carbonate having a specific gravity of 35° Baume was tried in one set of experiments (G-3, G-76 and G-77, table 4). The effect of this material on the eggs is similar to that of dormant strength lime-sulfur. The proportion of hatched eggs was 15.3 per cent with a 1-19 dilution, and 2.6 per cent with a 1-9 dilution, while the check showed 62.8 per cent hatched. These results are similar to those obtained when lime-sulfur was used, and it is possible that sodium sulfo-carbonate as a spray might be used with as much success as lime-sulfur.

Sodium chloride (common salt) was experimented with at the rate of 1 gm. to 5 cc. of water on the eggs of *A. avenæ* in the greenhouse (exp. G-4 and G-75, table 4) and out-of-doors (exp. 0-6 and 0-74, table 4) and the proportion of hatched eggs was somewhat lower among the sprayed eggs than in the respective checks. This shows that sodium chloride may prevent the less resistant eggs from hatching. Common salt in combination with lime-sulfur apparently does not materially increase or decrease the effectiveness of the lime-sulfur spray, according to the results in experiments G-17, 0-20 and 0-21 (table 4).

Sodium hydroxide at the rate of 2 gm. to 98 cc. of water has a decided influence on the percentage of hatch of the eggs of *A. avenæ* in the greenhouse and out-of-doors. In experiments 0-72 and 0-73 (table 4) the proportion of hatched eggs was reduced to 9.6 per cent and 1.8 per cent, respectively. A 2 per cent solution has a decided caustic effect which is particularly noticeable if the material is allowed to remain on the bare skin of one's hand. No experiments were conducted with this material on trees during the dormant season; consequently, its effect is unknown.

Pyridine (10 cc.) combined with xylene (10 cc.) and resin (enough to make 25 cc. of solution) is a very effective mosquito larvicide, so this mixture was given a trial. In experiment 0-78 (table 4) where the above mixture was used at the rate of 2 parts to 98 of water plus enough soap to make the spray spread well,

there was little or no reduction in the percentage of hatch. This solution was also mixed with lime-sulfur (G-16, table 4) with no apparent change in the results. It was also combined with crude carbolic acid (exp. 0-79, table 4) at the rate of 1 part of each to 100 cc. of soapy water, and the percentage of hatch was reduced to 13.3 per cent. This decided decrease was unquestionably due to the crude carbolic acid. The pyridine mixture is highly volatile and this may account for its ineffectiveness.

SUMMARY

In the summary only the new and important features of this investigation will be considered.

A morphological study of the eggs of three apple plant lice *A. avenæ, A. pomi* and *A. sorbi* shows two distinct layers in the egg shell, an outer semi-transparent layer which is soft and glutinous when the egg is deposited, but hardens and becomes somewhat tough (may be brittle) and impervious upon long exposure to weather, and an inner soft, elastic, membraneous, black layer. A third layer thin and membraneous, may be seen about the nymph when it starts to emerge. This skin is probably the first exuvium, since it is shed by the nymph as it emerges.

Under out-of-door conditions the outer layer of the egg usually splits along the dorso-mesal line a number of days (2 to 30 or more for *A. avenæ)* before the nymph emerges. So far as observed under greenhouse conditions the eggs of all three species split their outer covering at least a few hours before the pigmented layer is severed. In 1918 the first eggs of *A. avenæ* with split outer coverings were seen on February 15, and when the first nymphs emerged, on March 21, approximately 95 per cent of the normal live eggs (45-50 per cent of the eggs were dead) had split their outer semi- transparent covering.

These observations on the morphology and behavior of the egg coverings show conclusively that the egg is not a hard resistant body, and that it goes through a critical change previous to the emergence of the nymph. It is in the midst of this critical period that the egg is most susceptible to evaporating factors and certain contact insecticides.

The outer semi-transparent layer of the egg is somewhat impervious to water; consequently, the water content of the embryo does not undergo very much evaporation in moist weather, or in other words, when low evaporating factors exist, such as high humidity, low temperature, and probably small wind velicity. The outer layer, however, is not entirely impervious, for extreme drought

will cause the vast majority of the eggs to shrivel and never hatch. In other words, low humidity, high temperature and probably air velocity undoubtedly bring about a greater evaporation of the water content of the embryo, and thus destroy the living form.

The inner pigmented (black) layer of the egg is not an efficient protector against evaporation. Numerous and varied experiments at the laboratory and observations made on the percentage of hatched eggs of *A. avenæ* during the past two totally different seasons, 1917 and 1918, show conclusively the pervious nature of this layer.

The eggs are most susceptible to evaporating factors and contact insecticides during the latter part of March, or in other words, when the greatest number show a split outer layer, and this occurs when the first nymphs start to emerge (fig. 7 and 10).

Experiments conducted in the laboratory under controlled percentages of moisture and also experiments where similar eggs of *A. avenæ* were kept out-of-doors during the critical period (February 15 to March 31, and especially important March 15 to March 31) in 1917 which was wet, while in 1918 this period was dry, show quite conclusively that the percentage of hatched eggs is much higher in a low evaporating environment than in a high evaporating medium.

Contact insecticides probably prevent the egg from hatching in several ways. From a physical viewpoint some substances tend to harden the outer semi-transparent shell (lime-sulfur), and this makes it impossible for the nymphs to split the hardened layer. This hardening effect may be due to dessication. Dessicating substances may also remove the water content of the embryo within, especially if applied after the outer layer has split. Other substances soften and disintegrate the outer impervious layer (crude carbolic acid and cresols) and thus expose the inner pigmented layer to evaporating factors. The above physical reaction of contact insecticides on eggs of aphides may be important, but it is probable that the toxic effect upon the embryo of various contact insecticides is more important. So far, no technic has been found which will determine the penetrative ability of the various chemicals used.

CONTROL MEASURES

In conclusion to the foregoing experiments and observations we can safely recommend as a control measure for aphids a delayed dormant spray of lime-sulfur, 1-8 or 1-9, combined with nicotine ("Black-leaf 40"), 1-500. The combined spray kills 98-100 per cent of all the eggs that are coated and will also kill all the newly-hatched nymphs, provided they are hit with the spray. Dormant

lime-sulfur 1-9 by itself will kill a large percentage (90 per cent or better) of the eggs, but not enough to rely upon it alone. Furthermore, lime-sulfur alone will kill only a small percentage of the newly-hatched nymphs if they have made their appearance. Therefore, a combined spray is better, for it will kill a greater percentage of eggs and all the nymphs.

The time of application is important. In the foregoing discussion on the behavior of the outer layer of the egg it was shown that the egg is most easily killed when the outer shell has split (plate 1, fig. 2-5) and the greatest number of eggs show a split outer shell when the nymphs are emerging. With these facts in mind one can get the best results by delaying the dormant spray until the fruit buds start to swell and when they first show green. At this stage the eggs of the oat aphis *A. avena* will be hatching while the eggs of the rosy aphis, *A. sorbi,* and the green apple aphis, *A. pomi,* will not hatch for 7 to 14 days later. The dormant spray will not injure swollen fruit buds (plate 2, fig. B) or those showing short projecting tips of leaves (plate 2, fig. C), while a dormant spray applied when the leaves are distinct and separated (plate 2, fig. D) will burn the foliage of most varieties. Also, the recently-emerged nymphs of the aphides will conceal themselves to a large extent between the separated leaves, and it will be impossible to hit all of them with a contact spray.

A miscible oil, ''Scalecide'' 1-5, has been given a thorough trial in the orchard and at the laboratory, but it has not produced satisfactory results. Some eggs are killed by ''Scalecide'' and other miscible oils, but we have not used any which give as good control as a combined lime-sulfur and nicotine spray. Miscible oils containing derivatives of carbolic acid give more perfect control than those which do not possess the same; however, there is some indication that an amount of acid (2 per cent of the spray) sufficient to kill all the eggs may be detrimental to dormant buds.

Other contact sprays, such as a strong solution of fish-oil soap, combined with nicotine 1-500 or crude carbolic acid 1.5 to 2 per cent, give considerable promise of becoming effective sprays for the control of aphides in the egg stage when applied near the time when the nymphs emerge. These studies are as yet in the experimental stage, consequently, we cannot recommend the treatments for orchard spraying. Any soap spray spreads better than lime-sulfur, and for this reason they may prove to be more efficient. Crude carbolic acid or cresol U. S. P. combined with fish-oil soap will not injure dormant buds, so far as observed.

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ANALYSES OF MATERIALS SOLD AS INSECTICIDES AND FUNGICIDES DURING 1918

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ANALYSES OF MATERIALS SOLD AS INSECTICIDES AND FUNGICIDES DURING 1918

By

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and

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In accordance with the requirement of the law of New Jersey entitled "An Act to Regulate the Sale of Insecticides," the annual inspection for the year 1918 was made and the results obtained are herewith presented.

Registrations

The law requires an annual registration of the brands of materials that will be offered for sale, and in accordance with this requirement the following manufacturers registered 192 brands:

Allen Manufacturing Co.	Quakertown, N. J.
Aphine Manufacturing Co.	Madison, N. J.
E. J. Barry	New York City.
James A. Blanchard Co.	New York City.
Bowker Insecticide Co.	Boston, Mass., and Baltimore, Md.
Bristol-Myers Co.	Brooklyn, N. Y.
Cinnakol Chemical Sales Co.	Bayonne, N. J.
Corona Chemical Co.	Milwaukee, Wis.
Danforth Chemical Co.	Leominster, Mass.
Devoe & Raynolds Co., Inc.	New York City.

Dow Chemical Co	Midland, Mich.
Felton, Sibley & Co., Inc	Philadelphia, Pa.
Samuel H. French & Co	Philadelphia, Pa.
General Chemical Co	New York City.
The Glidden Co	Cleveland, O.
Grasselli Chemical Co	Cleveland, O.
Hemingway & Co	Bound Brook, N. J.
Morris Herrmann & Co	New York City.
Interstate Chemical Co	Jersey City, N. J.
Kentucky Tobacco Product Co	Louisville, Ky.
The Kil-Tone Co	Vineland, N. J.
Fred L. Lavanburg Co	New York City.
Arthur Laver	Bernardsville, N. J.
Leggett & Brother	New York City.
Lehn & Fink, Inc	New York City.
John Lucas & Co., Inc	Philadelphia, Pa.
McCormick & Co., Inc	Baltimore, Md.
Mechling Bros. Manufacturing Co	Camden, N. J.
The Mendleson Corporation	Albany, N. Y.
Merrimac Chemical Co	Boston, Mass.
Niagara Sprayer Co	Middleport, N. Y.
Nitrate Agencies Co	New York City.
Pfeiffer Color Co	New York City.
The Plantlife Co	New York City.
Powers-Weightman-Rosengarten Co	Philadelphia, Pa.
B. G. Pratt Co	New York City.
The Rex Co	Rochester, N. Y.
Riches, Piver & Co	Hoboken, N. J.
Schering & Glatz, Inc	New York City.
Sherwin-Williams Co	Cleveland, O.
H. J. Smith & Co	Utica, N. Y.
Smith, Kline & French Co	Philadelphia, Pa.
Sterling Chemical Co	Cambridge, Mass.
Vreeland Chemical Co	Little Falls, N. J.

INSPECTION

The collection of the samples of insecticides, taken as a whole, is more difficult than any of the inspections which the Station is required to make, and this is largely due to the mechanical condition of many of the materials used. It is fully appreciated that in order to secure results by the chemical analyses which would represent the shipment, it is absolutely necessary to have a sample that is representative.

Accurate sampling of the dry, powdered materials can be made without much difficulty provided the usual care is taken, but the

sampling of the materials in a paste form presents problems which under certain conditions cannot be overcome.

The instructions given the sampler for securing the samples of such materials would result in securing an accurate sample from a package which had not been opened, because the material must be thoroughly mixed before the sample is drawn. Very frequently, however, a request is made to take a sample from a keg which has been opened and a portion of the contents removed. It is quite possible in such cases that the sample will have a lower content of water than was contained in the material at the time of shipment, and consequently there would be a higher content of the solid constituents. The result of this condition is that the analysis of the sample taken may give the correct percentage for the weight of material purchased, or it may indicate that the material contains a higher percentage composition than guaranteed. It is safe to say, however, that the results would seldom show a lower composition than the actual figures obtained at the time of shipment.

In order to secure results that would fairly represent the brand, it has been our practice to obtain samples in their original packages as well as those taken from the larger shipments. The samples obtained in original packages are subsampled in the laboratory and in such a manner as to remove any possible doubt as to the accuracy of the portion taken for analysis.

In making an interpretation of the reports it is necessary to have in mind the above facts in order that correct conclusions may be reached.

The total number of samples collected was 95. This report contains the results obtained by the analysis of 89 samples, consisting of:

12 samples of Paris Green.
25 samples of Lead Arsenate.
9 samples of Bordeaux Mixture.
6 samples of Lime Sulphur.
4 samples of Tobacco Products.
33 samples of Miscellaneous Brands.

Twelve samples of Paris green are reported, six of which were received in original packages. The samples received in original packages were carefully weighed with and without the container and all of the packages were found to contain the full weight claimed.

The law fixes the standard for Paris green, since the material is deemed adulterated (1) if it does not contain at least 50 per cent of arsenious oxide, and (2) if it contains arsenic in water-soluble forms equivalent to more than 3.50 per cent of arsenious oxide. In accordance with these requirements all of the samples were satisfactory.

Paris green is essentially copper aceto-arsenite and, if pure, the ratio of the content of arsenic stated in terms of arsenious oxide to the content of copper stated in terms of copper oxide is 1.87 to 1.00. The ratio was calculated for each of the samples examined, and it was found that five samples, Nos. 18067, 18041, 18060, 18088 and 18042, gave a wider ratio than the theoretical, which would indicate the presence of uncombined arsenic.

Table 1

PARIS GREEN

Station Number	Manufacturer or Jobber and Trade Mark or Brand	Arsenious Oxide, Total, Found	Arsenious Oxide, Total, Guaranteed	Arsenious Oxide, Water-Soluble, Found	Arsenious Oxide, Water-Soluble, Guaranteed not more than	Copper Oxide
		%	%	%	%	%
	E. J. Barry, New York City					
18067	Strictly Pure Paris Green ...	52.17	50.00	2.68	3.50	27.01
	Jas. A. Blanchard, New York City.					
18041	Lion Brand Paris Green ...	50.90	50.00	2.91	3.50	24.84
18060	Lion Brand Paris Green ...	55.02	50.00	2.01	3.50	28.82
	F. W. Devoe & C. T. Raynolds Co., New York City.					
18006	C. T. Raynolds & Co.'s Paris Green ...	56.06	50.00	1.45	3.50	30.03
	Fred L. Lavanburg, New York City.					
18088	Star Brand Paris Green ...	56.52	50.00	1.34	3.50	29.67
	Leggett & Bro., New York City.					
18005	Anchor Brand Pure Paris Green ...	56.17	50.00	1.12	3.50	30.03
18083	Anchor Brand Pure Paris Green ...	55.33	50.00	1.01	3.50	29.67
	Nitrate Agencies Co., New York City.					
18040	Vitrio Paris Green ...	54.66	50.00	1.45	3.50	29.43
18042	Vitrio Paris Green ...	56.17	50.00	1.79	3.50	28.58
	Pfeiffer Color Co., New York City.					
18043	Strictly Pure Paris Green ...	55.52	50.00	1.34	3.50	29.55
18072	Strictly Pure Paris Green ...	55.40	50.00	1.34	3.50	29.31
	Sherwin-Williams Co., Cleveland, O.					
18004	Strictly Pure Paris Green ...	55.94	50.00	1.68	3.50	30.27

Table 2

LEAD ARSENATE—PASTE—Original Packages

Station Number	Manufacturer or Jobber and Trade Mark or Brand	Water	Total Arsenic Oxide		Water-Soluble Arsenic (Metallic)		Lead Oxide	Soluble Impurities (exclusive of Soluble Arsenic)
			Found	Guaranteed	Found	Guaranteed not more than		
		%	%	%	%	%	%	%
	Grasselli Chemical Co., Cleveland, O.							
18094	Grasselli Arsenate of Lead Paste.	48.78	16.83	15.00	0.18	0.50	31.62	0.71
	Hemingway & Co., Inc., Bound Brook, N. J.							
18078	Lead Arsenate Paste	43.68	16.70	15.06	0.15	0.50	38.44	1.06
	Interstate Chemical Co., Jersey City							
18061	Target Brand Arsenate of Lead Paste	40.69	17.59	15.50	0.11	.....	39.46	1.76
18084	Key Brand Arsenate of Lead Paste	32.13	21.36	15.50	0.13	.....	43.86	1.61
	Powers-Weightman-Rosengarten Co., Philadelphia, Pa.							
18081	P-W-R Lead-Arsenate Paste......	46.98	17.25	15.00	0.14	0.75	33.89	0.65

LEAD ARSENATE—PASTE—Samples of Larger Shipments

Station Number	Manufacturer or Jobber and Trade Mark or Brand	Water	Total Arsenic Oxide Found	Total Arsenic Oxide Guaranteed	Water-Soluble Arsenic Found	Water-Soluble Arsenic Guaranteed not more than	Lead Oxide	Soluble Impurities
	Ansbacher Insecticide Co., N. Y. City.							
18021	Triangle Brand Arsenate of Lead Paste	49.25	16.33	15.00	0.74	0.50	31.08	2.08
	Bowker Insecticide Co., Boston, Mass.							
18087	Bowker's Arsenate of Lead Paste	47.25	15.91	14.00	0.20	*0.39	33.53	2.05
	General Chemical Co., New York City.							
18046	Orchard Brand Standard Arsenate of Lead Paste	46.91	16.98	15.00	0.49	0.49	34.07	1.35
	Interstate Chemical Co., Jersey City.							
18022	Key Brand Arsenate of Lead Paste	50.28	16.18	15.50	0.27	.....	31.93	0.83

* Calculated from guarantee given in terms of arsenic oxide.

Table 2—(Continued)

LEAD ARSENATE—POWDER

Station Number	Manufacturer or Jobber and Trade Mark or Brand	Total Arsenic Oxide		Water Soluble Arsenic (Metallic)		Lead Oxide	Soluble Impurities (exclusive of Soluble Arsenic)
		Found	Guaranteed	Found	Guaranteed not more than		
		%	%	%	%	%	%
	Ansbacher Insecticide Co., New York City.						
18029	Triangle Brand Dry Arsenate of Lead..	32.47	30.00	0.92	[2]0.65	62.67	2.09
	Corona Chemical Co., Newark, N. J.						
18032	Dry Powdered Arsenate of Lead	33.12	[1]29.90	0.46	0.50	64.05	0.95
18089	Dry Powdered Arsenate of Lead	32.40	[1]29.90	0.36	0.50	65.10	0.44
	General Chemical Co., New York City.						
18024	Orchard Brand Standard Powdered Arsenate of Lead	31.97	31.00	0.82	0.96	64.31	1.74
18025	Orchard Brand Standard Powdered Arsenate of Lead	31.03	30.00	0.82	0.98	65.09	2.04
	Grasselli Chemical Co., Cleveland, O.						
18093	Grasselli Arsenate of Lead Powder	32.18	31.00	0.37	0.50	64.98	0.39
	Interstate Chemical Co., Jersey City, N. J.						
18008	Key Brand Dry Powdered Arsenate of Lead	26.93	30.00	0.50	0.75	70.86	1.24
18023	Key Brand Dry Powdered Arsenate of Lead	26.21	30.00	0.28	0.75	70.12	1.32
	The Kil-Tone Co., Vineland, N. J.						
18027	Green Cross Dry Powdered Arsenate of Lead	30.24	30.00	0.45	0.66	66.57	0.80
18074	Green Cross Dry Powdered Arsenate of Lead	31.46	31.00	0.45	0.66	65.22	0.70
18071	Green Cross Dry Powdered Arsenate of Lead	31.03	31.00	0.64	0.66	66.02	0.52
	Sherwin-Williams Co., Newark, N. J.						
18007	Dry Powdered Arsenate of Lead	32.54	30.00	0.36	[2]0.65	63.47	1.44
18030	Dry Powdered Arsenate of Lead	33.06	30.00	1.37	[2]0.65	62.42	1.14
	Thomsen Chemical Co., Baltimore, Md.						
18075	Orchard Brand Powdered Arsenate of Lead (Standard)	31.82	31.00	1.12	0.98	64.15	2.13
	Vreeland Chemical Co., Little Falls, N. J.						
18050	Electro Dry Powdered Arsenate of Lead.	31.03	31.00	0.42	0.66	63.31	1.33
18065	Electro Dry Powdered Arsenate of Lead.	31.60	30.00	0.42	0.50	65.22	0.88

[1] Calculated from guarantee given in terms of metallic arsenic.

[2] Calculated from guarantee given in terms of arsenic oxide.

Twenty-five samples of lead arsenate were examined, nine of which were in the paste form and the remainder were in the form of a dry powder. Seven of the samples were received in original packages and the net weight of the contents in six instances equalled or exceeded the weight claimed. The other sample, No. 18084, was in the paste form and the carton was damaged. It is quite possible that the difference in weight was caused by a loss of water, as the analysis shows a low water content for this class of material.

In accordance with the standard as given in the law, a lead arsenate would be considered adulterated (1) if it contains more than 50 per cent of water, (2) if it contains less than 12.50 per cent of arsenic oxide, and (3) if it contains water-soluble arsenic equivalent to more than 0.75 per cent of arsenic oxide.

Seven of the samples in the paste form satisfied all of the requirements, but one sample, No. 18022, contained a slight excess of water, and another sample, No. 18021, contained an excess of water-soluble arsenic.

Eleven samples of the powdered lead arsenate satisfied the guarantees given. Two samples, Nos. 18008 and 18023, were low in content of total arsenic oxide, and three samples, Nos. 18029, 18030 and 18075, contained an excess of water-soluble arsenic.

Bordeaux Mixtures

18011. Lion Brand Bordeaux Mixture. Manufactured by Jas. A. Blanchard Co., New York City.

18033. Corona Dry Bordeaux Mixture. Manufactured by Corona Chemical Co., Newark, N. J.

18047. Orchard Brand Bordeaux Mixture (Paste). Manufactured by General Chemical Co., New York City.

18012. Key Brand Bordeaux Mixture (Dry Powder). Manufactured by Interstate Chemical Co., Jersey City, N. J.

18063. Target Brand Bordeaux Mixture (Liquid). Manufactured by Interstate Chemical Co., Jersey City, N. J.

18086. Key Brand Bordeaux Mixture. Manufactured by Interstate Chemical Co., Jersey City, N. J.

18059. Leggett's Dry Bordeaux Mixture. Manufactured by Leggett and Brother, New York City.

18077. Anchor Brand Bordeaux Mixture (Paste). Manufactured by Leggett and Brother, New York City.

18068. Sterlingworth Liquid Bordeaux Mixture. Manufactured by Sterling Chemical Co., Cambridge, Mass.

Sample No.	Water	Copper	
		Found	Guaranteed
	per cent	per cent	per cent
18011	71.16	4.28	4.00
18033	.....	10.94	11.00
18047	60.65	10.09	9.00
18012	.....	10.31	10.00
18063	73.43	3.88	4.00
18086	77.97	4.05	4.00
18059	.....	12.01	11.00
18077	53.23	5.67	4.50
18068	68.22	3.01	3.00

LIME-SULPHUR SOLUTIONS

19038. Orchard Brand Lime-Sulphur Solution. Manufacture by General Chemical Co., New York City.

18082. Grasselli Lime-Sulphur Solution. Manufactured by Grasselli Chemical Co., Cleveland, O.

18091. Grasselli Lime-Sulphur Solution. Manufactured by Grasselli Chemical Co., Cleveland, O.

18039. Lime-Sulphur Solution. Manufactured by J. L. Lippincott Co., Riveerton, N. J.

18064. Lime-Sulphur Solution. Manufactured by Mechling Bros. Manufacturing Co., Camden, N. J.

18070. Lime-Sulphur Solution. Manufactured by Mechlin Bros. Manufacturing Co., Camden, N. J.

Sample No.	Sulphur in Solution		Density: Degrees Baumé
	Found	Guaranteed	
	per cent	per cent	
18038	25.67	25.00	33.
18082	26.74	25.00	33.
18091	26.26	25.00	33.
18039	15.89	.....	24.
18064	26.44	25.00	33.
18070	28.13	25.00	34.

TOBACCO PRODUCTS

18092. Grasselli Brand Sulphate of Nicotine. Manufactured by Grasselli Chemical Co., Cleveland, O.

18002. Nico-Fume Liquid. Manufactured by Kentucky Tobacco Products Co., Louisville, Ky.

18003. Black Leaf 40. Manufactured by Kentucky Tobacco Products Co., Louisville, Ky.

18001. Sterlingworth Powdered Tobacco. Manufactured by Sterling Chemical Co., Cambridge, Mass.

Sample No.	Nicotine	
	Found	Guaranteed
	per cent	per cent
18092	17.09	15.00
18002	40.40	40.00
18003	40.92	40.00
18001	0.77	0.35

Miscellaneous Materials

18019. Triangle Brand Adheso Green Label. Manufactured by Ansbacher Insecticide Co., New York City. Sample from 300-pound package.

	Found	Guaranteed
	per cent	per cent
Water	61.30	....
Total Arsenic (Metallic)	5.62	5.50
Water-Soluble Arsenic (Metallic)	0.14	*0.50
Lead Oxide	16.53	....
Copper (Metallic)	4.34	4.00

*Guaranteed "less than" percentage given.

18053. Triangle Brand Adheso Yellow Label. Manufactured by Ansbacher Insecticide Co., New York City. Sample from 300-pound package.

	Found	Guaranteed
	per cent	per cent
Water	68.45	....
Copper (Metallic)	6.01	7.80

18054. Triangle Brand Ansbor Green Powder. Manufactured by Ansbacher Insecticide Co., New York City. Sample from 100-pound package.

	Found	Guaranteed
	per cent	per cent
Total Arsenic (Metallic)	14.11	11.00
Water-Soluble Arsenic (Metallic)	0.47	*3.00
Copper (Metallic)	17.70	....

*Guaranteed "less than" percentage given.

18013. Pyrox. Manufactured by Bowker Insecticide Co., Boston, Mass. Sample from 1-pound package.

18016. Pyrox. Manufactured by Bowker Insecticide Co., Boston, Mass. Sample from 50-pound package.

	Sample 18013		Sample 18016	
	Found	Guaranteed	Found	Guaranteed
	per cent	per cent	per cent	per cent
Water	61.06	....	58.37	....
Total Arsenic (Metallic)	4.94	3.42	5.49	3.42
Water-Soluble Arsenic (Metallic)	0.21	*0.75	0.22	*0.75
Lead Oxide	13.08	12.00	20.21	12.00
Copper (Metallic)	3.12	1.50	2.97	1.50

*Guaranteed "not more than" percentage given.

18048. Orchard Brand Powdered Arsenite of Zinc. Manufactured by General Chemical Co., New York City. Sample from 300-pound package.

	Found	Guaranteed
	per cent	per cent
Total Arsenic (Metallic)	33.50	30.50
Water-Soluble Arsenic (Metallic)	0.18	*1.00

*Guaranteed "not more than" percentage given.

18045. Orchard Brand Bordeaux Lead, Paste. Manufactured by General Chemical Co., New York City. Sample from 100-pound package.

	Found	Guaranteed
	per cent	per cent
Water	46.23	....
Total Arsenic (Metallic)	4.93	3.90
Water-Soluble Arsenic (Metallic)	0.20	*0.49
Lead Oxide	18.38	....
Copper (Metallic)	7.18	5.40

*Guaranteed "not more than" percentage given.

18035. Lazal. Manufactured by General Chemical Co., New York City. Sample from 10-pound package.

18049. Lazal. Manufactured by General Chemical Co., New York City. Sample from 100-pound package.

	Sample 18035		Sample 18049	
	Found	Guaranteed	Found	Guaranteed
	per cent	per cent	per cent	per cent
Total Arsenic (Metallic)	27.38	27.00	26.87	27.00
Water-Soluble Arsenic (Metallic)	0.18	*1.00	0.27	*1.00

*Guaranteed "not more than" percentage given.

18937. Orchard Brand Atomic Sulphur. Manufactured by General Chemical Co., New York City. Sample from 300-pound package.

18076. Orchard Brand Atomic Sulphur. Manufactured by General Chemical Co., New York City.. Sample from 300-pound package.

	Sample 18037		Sample 18076	
	Found	Guaranteed	Found	Guaranteed
	per cent	per cent	per cent	per cent
Water	50.50	....	50.91	....
Sulphur	46.21	45.00	45.97	45.00

18079. Caascu. Manufactured by Hemingway & Co., Inc., Bound Brook, N. J. Sample from 5-pound package.

18080. Caascu. Manufactured by Hemingway & Co., Inc., Bound Brook, N. J. Sample from 1-pound package.

	Sample 18079		Sample 18080	
	Found	Guaranteed	Found	Guaranteed
	per cent	per cent	per cent	per cent
Total Arsenic (Metallic)	20.73	17.00	19.43	17.00
Water-Soluble Arsenic (Metallic)	2.02	*4.00	1.93	*4.00
Copper (Metallic)	7.23	....	6.68	....

*Guaranteed "not more than" percentage given.

18062. Target Brand Bordo Lead. Manufactured by Interstate Chemical Co., Jersey City, N. J. Sample from 1-pound package.

18073. Key Brand Bordo Lead. Manufactured by Interstate Chemical Co., Jersey City, N. J. Sample from 1-pound package.

18085. Key Brand Bordo Lead. Manufactured by Interstate Chemical Co., Jersey City, N. J. Sample from 1-pound package.

	Sample 18062		Sample 18073		Sample 18085	
	Found	Guaranteed	Found	Guaranteed	Found	Guaranteed
	per cent	per cent	per cent	per cent	per cent	per cent
Water	60.68	....	40.83	....	57.79	....
Total Arsenic (Metallic)	5.63	7.50	8.49	5.00	5.53	5.00
Water-Soluble Arsenic (Metallic)	0.15	....	0.21	*0.50	0.14	*0.50
Lead Oxide	18.68	....	24.25	....	17.69	....
Copper (Metallic)	1.58	....	3.40	....	1.99	....

*Guaranteed "not more than" percentage given.

18017. Improved Kil-Tone. Manufactured by The Kil-Tone Co., Vineland, N. J. Sample from 150-pound package.

18057. Improved Kil-Tone. Manufactured by The Kil-Tone Co., Vineland, N. J. Sample from 100-pound package.

	Sample 18017		Sample 18057	
	Found	Guaranteed	Found	Guaranteed
	per cent	per cent	per cent	per cent
Water	43.31	....	54.80	....
Total Arsenic (Metallic)	8.02	5.80	7.00	5.80
Water-Soluble Arsenic (Metallic)	0.24	0.11	0.24	0.11
Lead Oxide	27.60	....	22.46	....
Copper (Metallic)	2.64	....	1.94	....

18058. Modified Kil-Tone. Manufactured by The Kil-Tone Co., Vineland, N. J. Sample from 150-pound package.

	Found	Guaranteed
	per cent	per cent
Water	59.80	....
Copper (Metallic)	6.03	5.58

18018. Beetle Mort. Manufactured by The Kil-Tone Co., Vineland, N. J. Sample from 75-pound package.

18056. Beetle Mort. Manufactured by The Kil-Tone Co., Vineland, N. J. Sample from 40-pound package.

	Sample 18018		Sample 18056	
	Found	Guaranteed	Found	Guaranteed
	per cent	per cent	per cent	per cent
Total Arsenic (Metallic)	13.05	13.50	13.79	13.50
Water-Soluble Arsenic (Metallic)	0.59	*0.66	0.27	*0.66
Copper (Metallic)	4.65	3.00	4.28	3.00

*Guaranteed "not more than" percentage given.

18051. Green Cross Sulpho-Arsenate Powder. Manufactured by The Kil-Tone Co., Vineland, N. J. Sample from 100-pound package.

	Found	Guaranteed
	per cent	per cent
Total Arsenic (Metallic)	10.65	10.10
Water-Soluble Arsenic (Metallic)	0.36	*0.66
Lead Oxide	32.89	....
Sulphur	48.79	48.00

*Guaranteed "not more than" percentage given.

18014. Dry Bordeaux Mixture and Paris Green Compound. Manufactured by Leggett & Brother, New York City. Sample from 1-pound package.

	Found	Guaranteed
	per cent	per cent
Total Arsenic (Metallic)	14.87	12.50
Water-Soluble Arsenic (Metallic)	0.55	*2.00
Copper Oxide	18.66	19.00

*Guaranteed "not more than" percentage given.

18034. B-Bly-D Bug Dust No. 3. Manufactured by Leggett & Brother, New York City. Sample from 25-pound package.

	Found	Guaranteed
	per cent	per cent
Total Arsenic (Metallic)	16.43	16.00
Water-Soluble Arsenic (Metallic)	0.23	*2.00
Copper (Metallic)	9.45	....

*Guaranteed "not more than" percentage given.

18020. Mechling's Green Label Hydroxide No. 2, Paste. Manufactured by Mechling Bros. Manufacturing Co., Camden, N. J. Sample from 1-pound package.

	Found	Guaranteed
	per cent	per cent
Water	43.62	....
Tatal Arsenic (Metallic)	9.21	6.50
Water-Soluble Arsenic (Metallic)	0.15	*0.50
Lead Oxide	30.39	....
Copper (Metallic)	1.94	1.50

*Guaranteed "less than" percentage given.

18015. Tuber-Tonic. Manufactured by Sherwin-Williams Co., Newark, N. J. Sample from 25-pound package.

18090. Tuber-Tonic. Manufactured by Sherwin-Williams Co., Newark, N. J. Sample from 50-pound package.

18052. Tuber-Tonic. Manufactured by Sherwin-Williams Co., Newark, N. J. Sample from 1-pound package.

	Sample 18015		Sample 18090		Sample 18052	
	Found	Guaranteed	Found	Guaranteed	Found	Guaranteed
	per cent	per cent	per cent	per cent	per cent	per cent
Total Arsenic (Metallic)	26.77	24.00	24.36	24.00	26.00	24.00
Water-Soluble Arsenic (Metallic)	0.55	*3.00	0.55	*3.00	0.55	*3.00
Copper (Metallic)	23.13	....	23.25	....	23.37	....

*Guaranteed "not over" percentage given.

18095. Dry Powdered Insecto. Manufactured by Sherwin-Williams Co., Co., Newark, N. J. Sample from 50-pound package.

	Found	Guaranteed
	per cent	per cent
Total Arsenic (Metallic)	11.14	12.00
Water-Soluble Arsenic (Metallic)	0.27	*0.50
Lead Oxide	33.54	....
Copper (Metallic)	5.13	....

*Guaranteed "not over" percentage given.

18069. Dry Powdered Arsenate of Calcium and Lead. Manufactured by H. J. Smith & Co., Utica, N. Y. Sample from 50-pound package.

	Found	Guaranteed
	per cent	per cent
Total Arsenic (Metallic)	13.75	13.00
Water-Soluble Arsenic (Metallic)	0.46	*1.40
Lead Oxide	2.15	....

*Guaranteed "not over" percentage given.

18028. Orchard Brand Powdered Arsenite of Zinc. Manufactured by Thomsen Chemical Co., Baltimore, Md. Sample from 50-pound package.

	Found	Guaranteed
	per cent	per cent
Total Arsenic (Metallic)	33.17	30.50
Water-Soluble Arsenic (Metallic)	0.27	*1.00

*Guaranteed "not more than" percentage given.

18031. Electro Micro. Manufactured by Vreeland Chemical Co., Little Falls, N. J. Sample from 100-pound package.

	Found	Guaranteed
	per cent	per cent
Total Arsenic (Metallic)	10.39	9.25
Water-Soluble Arsenic (Metallic)	0.27	*0.50
Lead Oxide	31.18	....
Sulphur	50.37	48.00

*Guaranteed "not more than" percentage given.

18066. Electro Bordo Lead Mixture. Manufactured by Vreeland Chemical Co., Little Falls, N. J. Sample from 1-pound package.

	Found	Guaranteed
	per cent	per cent
Water	51.83	....
Total Arsenic (Metallic)	4.18	3.64
Water-Soluble Arsenic (Metallic)	0.18	*0.50
Lead Oxide	11.21	....
Copper (Metallic)	1.95	....

ANALYSES OF COMMERCIAL FERTILIZERS AND GROUND BONE;
ANALYSES OF AGRICULTURAL LIME

NEW JERSEY

AGRICULTURAL

Experiment Stations

BULLETIN 334

New Brunswick, N. J.

NEW JERSEY AGRICULTURAL EXPERIMENT STATIONS*

NEW BRUNSWICK, N. J.

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ORGANIZED 1912

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CONTENTS

NEW JERSEY

Agricultural Experiment Stations

BULLETIN 334

December 23, 1918

ANALYSES OF COMMERCIAL FERTILIZERS AND GROUND BONE; ANALYSES OF AGRICULTURAL LIME

BY

Charles S. Cathcart, *State Chemist* [1]

A portion of the results obtained during the fertilizer inspection for 1918 was published in Bulletin 331, and the remaining analyses, together with a discussion of the whole inspection, are herewith presented.

Authority for Making the Inspection

The law entitled "An Act Concerning Fertilizers," approved March 27, 1912, requires fertilizers to be sold under certain regulations and it also requires an annual inspection of the materials sold. This law has been published several times and it does not seem necessary to repeat it at this time. All persons interested in the sale and use of fertilizers, however, should be familiar with this law. Printed copies of this law are available and will be forwarded to those interested.

Registrations

During the year 122 manufacturers and jobbers registered 1408 brands of mixed fertilizers and fertilizer materials.

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[1]The analyses were made by Ralph L. Willis, Robert H. Cole, Louis Schwartz and Archie C. Wark.

All of these registrations were not made at the time prescribed in the law, since our inspectors secured samples of 51 brands before they were registered. Last year there were 86 brands found in this condition and the improvement is appreciated.

It has been our practice to publish in January of each year the registrations made up to that time. In accordance with this practice Bulletin 321 was issued under date of January 28, 1918, and it contained all of the registrations for the fiscal year made up to that date. The registrations received since that date will be found in this bulletin.

REPORTS OF TONNAGE

The law requires the manufacturers or parties responsible for the sale of fertilizers in this state to render on April first and November first of each year a certified report of the tonnage sold during the preceding months. The reports were duly rendered and table 1 will show the tonnage reported during the last six years.

TABLE 1

SUMMARY OF TONNAGE REPORTS

Year	April Reports		November Reports		
	Mixed Fertilizers	Fertilizer Materials	Mixed Fertilizers	Fertilizer Materials	Total for the Year
	Tons	Tons	Tons	Tons	Tons
1913 ...	87,446.91	10,303.17	51,706.28	7,204.79	156,661.15
1914 ...	78,768.27	8,735.62	59,223.26	8,686.99	155,414.14
1915 ...	87,052.13	7,276.45	53,288.11	5,459.28	153,075.97
1916 ...	61,368.88	9,032.68	52,328.81	7,069.70	129,800.07
1917 ...	86,840.44	9,146.80	74,231.13	6,264.73	176,483.10
1918 ...	90,371.85	6,544.66	51,404.20	4,877.90	153,198.61

RULES AND REGULATIONS

The law provides that the state chemist shall have authority to establish rules and regulations in regard to the inspection, analyses and sale of fertilizers. In accordance with this provision the following rulings have been made:

1. Two reports are required annually, and the dates fixed by the law are April first and November first. The April report covers the sales from November first to April first, and the November report covers the sales from April first to November first.

2. Whenever a corporation, firm or person shall have filed a statement required by section 2 of the law and shall have paid the inspection fee as required by section 4 of the law, no other agent, importer, corporation, firm or person shall be required to pay the inspection fee upon such brands.

3. All corporations, firms or persons who have registered the regular brands manufactured by them and, also, the fertilizer materials offered for sale by them, can furnish mixtures, commonly known as "Special Mixtures" or "Special Compounds," which are prepared for immediate delivery and in accordance with a formula submitted by the purchaser, without having the mixture registered before filling the order, provided the following procedure is adopted:

(a) A certified statement is to be filed with the state chemist that it is desired to make "Special Mixtures" for immediate delivery in accordance with formula submitted by the purchaser, and that the tonnage of material used will be accounted for in the reports that are required to be rendered.

(b) The shipments of these "Special Mixtures" during the fiscal year are to be numbered consecutively, a record being made so that the formula with the guaranteed analysis of each ingredient used or the calculated guarantee of the mixture can be furnished the state chemist when he so requests.

(c) The shipments are to be in plain bags with tags attached, giving the following information:

Special Mixture No. (5).

Mixture of Registered Ingredients Prepared for (John Jones, Salem, N. J.)

Manufactured by (Smith Fertilizer Co., Camden, N. J.)

4. Reports on samples which are found to satisfy substantially the guarantees will be marked "Official," and are submitted to the consumer on the same date as to the manufacturer. When analyses show samples to be deficient, reports are submitted to manufacturers, and objections to the report or requests for a portion of duplicate sample must be made within 10 days from the date of report in order to receive consideration. Should a manufacturer's report on the official sample differ from our report, every effort will be made to locate the cause, but only those results that can be duplicated in this laboratory by the use of the methods adopted by the Association of Official Agricultural Chemists will be accepted as official.

The Trade Value of the Essential Elements of Plant-Food

The fluctuations in the prices of standard raw materials and chemicals during the years of 1916 and 1917 were so great that it was not deemed advisable to prepare a schedule of trade values. Inasmuch as the condition had not improved during the present year it is necessary to omit the schedule for the year 1918.

Collection of Samples

The work of collecting the samples of fertilizers and fertilizer materials was entrusted to our two inspectors and although an early and thorough inspection was made it was not possible to secure as many different brands as in the past few years. This condition may have been due to a smaller number of brands being sold or to the fact that fertilizer shipments are being made earlier than in the past years.

In addition to the usual spring collection, samples of the fall shipments were secured and as a result a few new brands were located as well as a number of samples of the brands which had been previously collected.

The inspectors visited every county in the state and a total of 1385 samples were received at the Station, all but a small percentage of which were collected by the official inspectors. The samples received represented the stock of 526 dealers and consumers who were located in 208 cities and towns.

The samples that were forwarded by individuals were duly examined and the reports submitted to the parties requesting the analyses.

Official Samples Selected for Examination

The samplers receive definite instructions regarding the method of sampling and also in regard to the number of samples to be taken of each particular brand, and as a result, in most cases two samples of a brand are collected and in other cases a larger multiple is received. It is not possible to examine all of these samples, and it is, therefore, necessary to make a selection from the collection at hand. In making this selection every brand collected is examined. If only one sample of a brand has been received there can be no selection but when more than one sample of a brand has been received it is our practice to select the one that represented the largest stock on hand at the time of sampling.

During the past few years the department has endeavored to discourage the sending of samples of the commercial fertilizers by individuals and the reason for this is that usually the sample does not represent the material and the value of the results obtained by the analysis of such a sample is doubtful. We are more than willing to be of service to the citizens of this state and this service can be made beneficial provided there is no injustice done to either the consumer or the manufacturer. If an analysis of a shipment is desired, the proper thing to do is to notify the state chemist that the shipment has been received and inform him as to the brand name of the material, the name of the manufacturer and the number of tons of the brand in stock. Upon receipt of such information, if the tonnage warrants, arrangements will be made to have an official sampler draw the sample for analysis without any expense to the party making the request. The analysis of such a sample would give more satisfactory results than it would if the sample had not been accurately drawn.

The samples analyzed during the present year consisted of the following:

502	Samples of Commercial Fertilizers.
69	Samples of Commercial Fertilizers (duplicates).
5	Samples of Home Mixtures.
10	Samples of Humus and Manures.
114	Samples of Fertilizer Materials.
46	Samples of Ground Bone.
168	Samples of Sundry Materials.
914	Samples, Total.

The Chemical Examination

Chemical investigations have shown that of all of the chemical elements necessary to plant life only three elements, nitrogen, phosphoric acid and potash, are likely to be deficient in the soils or most quickly exhausted by the production and removal of crops. These three elements, are, therefore, called "essential elements." In order to meet this condition about 6,500,000 tons are sold annually in the United States, while the approximate annual tonnage in New Jersey is 170,000 tons. It is almost impossible to give an accurate figure as to the cost of fertilizers used in this state, but for the year 1918 it undoubtedly amounted to $6,500,000 or more and, consequently, is an important item in our expense account.

All brands of commercial fertilizers are mixtures of various materials and the differences that exist in the brands of the different manufacturers are due to the differences in the character and to the variations in the quantities of the materials used in preparing the different brands. The value of any fertilizer depends upon the amount and form of the nitrogen, phosphoric acid and potash contained.

Generally speaking all of the manufacturers have an opportunity to secure the same classes of materials, while the amounts of these products used in the mixtures will depend upon the desires of the manufacturer at the time of making his mixtures.

The difference between a good fertilizer and a poor one is not so much a difference in the total amount of plant food contained as it is in the difference in the quality of the materials used to prepare the mixtures. This statement may be made clearer by assuming that one mixture had been prepared by the use of low grade nitrogenous materials and untreated phosphate, while another mixture had been prepared by the use of high grade ammoniates and acid phosphate. The total plant food in the two mixtures may be exactly the same but the immediate results obtained by the use of the first mixture would not be as satisfactory as those obtained by the use of the second mixture.

In order, therefore, to know the true value of a fertilizer it is necessary to determine not only its total content of plant-food but also the form in which these elements are present in the mixture.

The results tabulated in Bulletin 331 and on the following pages will show the form of the essential elements as well as the total content of plant-food and will thus permit those interested to determine which brands are best suited to their needs.

AVERAGE GUARANTEED AND ACTUAL COMPOSITION

The total number of brands of mixed fertilizers examined was 502, of which 214 were guaranteed to contain nitrogen, phosphoric acid and potash and the other 288 brands did not guarantee potash.

TABLE 2

AVERAGE OF 214 BRANDS CONTAINING NITROGEN, PHOSPORIC ACID AND POTASH

	Average		
	Found		Guaranteed
	Per Cent	Per Cent	Per Cent
Nitrogen, as nitrates	0.79	....	....
Nitrogen, as ammonia salts	0.63	....	....
Nitrogen, as water-soluble organic	0.27	....	....
Nitrogen, as water-insoluble organic	0.62	....	....
Nitrogen, total	....	2.31	2.33
Phosphoric acid, total	10.19	....	....
Phosphoric acid, insoluble	1.66	....	....
Phosphoric acid, available	....	8.53	8.33
Potash	....	1.96	1.89

TABLE 3

AVERAGE OF 288 BRANDS CONTAINING NITROGEN AND PHOSPHORIC ACID

	Average		
	Found		Guaranteed
	Per Cent	Per Cent	Per Cent
Nitrogen, as nitrates	0.72	....	....
Nitrogen, as ammonia salts	0.60	....	....
Nitrogen, as water-soluble organic	0.34	....	....
Nitrogen, as water-insoluble organic	0.73	....	....
Nitrogen, total	....	2.39	2.43
Phosphoric acid, total	11.64	....	....
Phosphoric acid, insoluble	1.82	....	....
Phosphoric acid, available	....	9.82	9.55

By referring to tables 2 and 3, it will be noted that the average composition of the brands examined was substantially equal to the average guarantees, the figures for total nitrogen being slightly less and the figures for phosphoric acid and potash being larger than the average guarantees. A detailed study of the record for each individual brand, however, will show that 114 brands fully sustained their guarantees and that 238 brands were substantially in the same condition. There were 150, or 30 per cent, deficient brands, 134 being deficient in one element and 16 deficient in two elements.

In order to compare the deficiencies with the preceding years table 4 has been prepared. In preparing this tabulation, deficiencies of 0.20 per cent or less of nitrogen and 0.30 per cent or less of phosphoric acid have been disregarded.

TABLE 4

COMPARISON OF DEFICIENCIES FROM 1908 TO 1918

Year	Number of Brands				Deficiencies Possible	Actual Deficiencies			
	Examined	Found as Guaranteed	Found Deficient	Percentage Deficient		Nitrogen	Phosphoric Acid	Potash	Percentage
1908 ..	463	227	236	51	1,389	96	149	31	19.8
1909 ..	483	280	203	42	1,449	71	137	36	16.8
1910 ..	520	316	204	39	1,560	51	142	45	15.3
1911 ..	514	341	173	34	1,542	36	115	42	12.5
1912 ..	536	326	210	39	1,608	47	146	33	14.1
1913 ..	623	457	166	28	1,869	74	86	36	10.5
1914 ..	608	420	188	31	1,824	63	92	49	11.2
1915 ..	543	367	176	32	1,629	94	83	31	12.8
1916 ..	565	356	209	37	1,406	139	81	17	16.9
1917 ..	552	380	172	31	1,360	85	88	15	13.8
1918 ..	502	352	150	30	1,218	82	69	15	13.6

In the 502 brands examined there were 1218 deficiencies possible, and of this number 166, or 13.6 per cent, were found. These deficiencies were distributed as follows:—nitrogen 82, phosphoric acid 69, and potash 15.

The record for this year compares very favorably with the report for 1917, if one is satisfied with such facts computed on a percentage basis. We have repeatedly stated that we believe the manufacturers intend to deliver the materials as guaranteed and we have no reason to change our opinion at this time. The deficiencies that have been found in the past were likely caused by inequalities in the mixing or by too closely calculating the formula from the analyses of the materials to be used in the mixtures. The margin of profit, per ton of mixed goods, has been relatively small for several years, and it is safe to assume that during the past year on account of the high prices and scarcity of the standard raw materials, the manufacturers could not afford to be too liberal in the use of the available stock when preparing their mixtures.

The purchaser of fertilizers should not expect to receive more plant-food than he paid for. He should, however, not only expect and demand the amount guaranteed, but it should be derived either from standard materials or from materials that had been treated in

order to make them available. There is, also, a possibility of an error having been made in the shipment, and in such cases there is no doubt but that the manufacturer will rectify the error, but it would be necessary to present conclusive evidence that an error had been made before the question could be satisfactorily settled.

It is, therefore, necessary to make these purchases in a careful manner in order that the money will be wisely invested, and the only way to do this is to have a positive knowledge of the composition of the material secured.

QUALITY OF THE PLANT-FOOD

It is well known that the elements of plant-food are contained in many different materials, some being in a good form to use as a fertilizer while others are not much better than an inert filler. There are also several materials that make poor fertilizers in their original condition, but which can be treated at the factory by some method in order to make the plant-food contained available.

On account of this condition it is of as much importance to know the form of the elements in a fertilizer as it is to know the total quantity of nitrogen, phosphoric acid and potash contained.

Of the total number of brands of mixed fertilizer examined, 308 contained a portion of the total nitrogen content in the form of nitrates, 299 brands contained nitrogen in the form of ammonia salts, and 175 brands contained both of these available forms. The organic nitrogen was present in two forms, soluble and insoluble. The soluble portion is considered in an available form, but the value of the insoluble portion depends largely upon its source. Determinations were made in order to ascertain the value of the insoluble nitrogen, and the results show that in 418 brands this form of nitrogen was available while 84 brands contained nitrogen of an inferior quality. Of the number of brands containing inferior nitrogen, 37 carried an excess of total nitrogen which would offset, in part at least, the quantity of inferior quality. These figures compared with those of last year will show that a larger number of brands this year contained an inferior grade of organic nitrogen than was found during the previous inspection. This is a condition that deserves the most careful attention.

The tabulations given in the reports show the percentage of insoluble nitrogen, and in those cases where it was found to be of inferior quality special attention is called to the fact. When no reference is made the results obtained show that it had an availability equal to some of the standard materials.

There are three forms of phosphoric acid usually present in a fertilizer and they are designated as (1) soluble in water, (2) soluble in ammonium citrate and (3) insoluble. The portion that is soluble in water is more widely distributed in the soil than either of the other forms. The sum of the portions that are soluble in water and soluble in ammonium citrate is called available phosphoric acid, and is considered to be readily available to the growing crops. The value of the insoluble portion depends upon its source, but since the greater portion of the phosphoric acid in mixed fertilizers is derived from treated phosphate rock, the amount that is insoluble is not an important item.

The potash content as reported is water soluble and is readily available.

STATION'S VALUATION AND SELLING PRICE

It has been customary at this Station to calculate the valuations of the fertilizers examined, but for reasons given on a previous page we were unable to make any valuations this year. As soon as conditions become normal these valuations will be given in order that the information may be more complete.

For years we have presented a tabulation showing the average composition and selling price of the fertilizers containing nitrogen, phosphoric acid and potash. We wish to keep this tabulation, but during the past three years it has not been complete on account of the valuation question. Table 5 will show the average composition of this class of fertilizers for the past ten years and the average selling price for seven years.

TABLE 5

AVERAGE COMPOSITION OF FERTILIZERS FOR TEN YEARS

Year	Total Nitrogen	Total Phosphoric Acid	Available Phosphoric Acid	Insoluble Phosphoric Acid	Potash	Station's Valuation	Selling Price	Actual Difference	Percentage Difference
	%	%	%	%	%				%
1909	2.57	9.63	7.39	2.24	6.51	$21.58	$30.12	$8.54	39.6
1910	2.52	9.60	7.40	2.20	6.58	22.38	29.67	7.29	32.6
1911	2.63	9.19	7.42	1.77	6.72	22.58	29.98	7.40	32.8
1912	2.64	9.17	7.43	1.74	6.71	22.54	29.43	6.89	30.6
1913	2.63	9.28	7.74	1.54	7.13	23.22	29.37	6.15	20.9
1914	2.66	9.24	7.75	1.49	6.91	22.40	29.51	7.11	24.1
1915	2.70	9.78	8.19	1.59	3.54	22.11	30.95	8.84	28.6
1916	2.39	10.67	8.98	1.69	1.39	.....	32.43	....	....
1917	2.63	10.51	8.73	1.78	1.83	.....	34.35	....	....
1918	2.31	10.19	8.53	1.66	1.96	.....	46.72	....	....

Ground Bone

Forty-six samples of ground bone were examined during the inspection and the results are tabulated on subsequent pages.

Table 6 will give the average composition for the past ten years.

TABLE 6

AVERAGE COMPOSITION OF GROUND BONE FOR TEN YEARS

	Fine	Coarse	Nitrogen	Phosphoric Acid	Valuation	Selling Price
	%	%	%	%		
Average, 1909..	63	37	2.98	24.01	$26.07	$28.23
" 1910..	66	34	2.77	24.27	28.70	29.83
" 1911..	65	35	2.64	23.11	27.31	28.69
" 1912..	57	43	2.99	22.89	27.73	31.12
" 1913..	60	40	2.83	23.53	27.62	32.44
" 1914..	60	40	2.82	23.24	29.97	32.40
" 1915..	57	43	2.96	23.77	29.24	33.50
" 1916..	53	47	2.80	23.80	.....	39.50
" 1917..	58	42	2.95	24.28	.....	38.32
" 1918..	59	41	2.85	24.84	.....	48.49

SUMMARY OF THE RESULTS OBTAINED WITH THE MIXED FERTILIZERS EXAMINED DURING THE INSPECTION OF 1918

Manufacturer	Address	Number of Brands Received	Number of Samples Examined	Number of Samples Satisfied Guarantees	Number of Samples Substantially Satisfied Guarantees*	Number of Samples Deficient in— Nitrogen	Phosphoric Acid	Potash	One Element	Two Elements	Three Elements
Acme Guano Co.	Baltimore, Md.	4	5	....	....	2	5	....	3	2	....
Active Chemical Co.	Camden, N. J.	9	9	4	2	3	....	....	3	....	....
American Agricultural Chemical Co.	New York City	69	78	14	47	9	8	....	17	....	....
American Fertilizer Co.	Baltimore, Md.	6	7	2	4	....	1	....	1	....	....
Armour Fertilizer Works	Baltimore, Md., and Chrome, N. J	16	16	5	3	1	3	....	2	1	....
J. H. Baird & Son	Marlboro, N. J.	1	1	1	....	....	....	....	....	....	....
Baltimore Pulverizing Co.	Baltimore, Md.	4	6	1	....	....	5	....	5	....	....
Baugh & Sons Co.	Philadelphia, Pa.	15	23	7	13	....	1	2	3	....	....
The Berg Co.	Philadelphia, Pa.	4	6	5	1	....	....	....	....	....	....
Berger Bros.	Easton, Pa.	1	1	....	1	....	....	....	....	....	....
Bowker Fertilizer Co.	New York City	15	17	3	7	5	1	3	5	2	....
Burlington County Farmers Exchange	Mt. Holly, N. J.	2	3	1	2	....	....	....	....	....	....
Chamberlain & Barclay	Cranbury, N. J.	1	1	1	....	....	....	....	....	....	....
E. D. Chittenden & Co.	Bridgeport, Conn.	1	1	..	...	....	....	1	1	....	....
Coe-Mortimer Co.	New York City	13	16	2	11	2	1	....	3	....	....
J. S. Collins & Son, Inc.	Moorestown, N. J.	4	4	...	2	2	1	....	1	1	....
Columbia Guano Co.	Baltimore, Md.	5	5	1	3	....	1	....	1	....	....
Consumers Chemical Corporation	Newark, N. J.	6	6	5	....	....	1	....	1	....	....
Jas. G. Downward Co.	Coatesville, Pa.	2	2	....	....	2	2	....	....	2	....
Fogg & Hires Co.	Salem, N. J.	1	1	1	....	....	....	....	....	....	....
Alex. Forbes & Co.	Newark, N. J.	2	2	....	....	1	2	....	1	1	....
Forman & Dilatush	Dayton, N. J.	1	1	....	....	....	1	....	1	....	....
Godfrey Co-operative Fert. & Chem. Co.	Newark, N. J.	15	16	2	6	5	4	1	6	2	....

Thos. Y. Hackett	Daretown, N. J.	3	3	2	....	....	....	1	1	....	....
Hendrickson & Dilatush	Robbinsville, N. J.	6	6	2	4	....	....	....	....	....	....
Heritage & Bro	Mullica Hill, N. J.	2	2	1	1	....	....	....	....	....	....
S. M. Hess & Bro., Inc	Philadelphia, Pa.	6	6	1	3	1	1	....	2	....	....
Hill Bros	Flemington, N. J.	2	2	....	2	....	....	....	....	....	....
Hubbard Fertilizer Co	Baltimore, Md.	1	1	....	....	1	....	....	1	....	....
Hutchinson & Rue	Windsor, N. J.	1	1	....	....	....	1	....	1	....	....
International Seed Co	Rochester, N. Y.	3	3	1	2	....	....	....	....	....	....
H. B. Kemp	Long Branch, N. J.	3	3	....	1	2	....	....	2	....	....
Keystone Bone Fertilizer Co	Philadelphia, Pa.	7	7	1	1	3	2	1	4	1	....
William Lancaster	Philadelphia, Pa.	5	7	....	3	3	....	1	4	....	....
Listers Agricultural Chemical Works	Newark, N. J.	19	22	5	14	2	1	....	2	1	....
Locke & Black	Swedesboro, N. J.	6	6	1	3	1	1	....	2	....	....
Frederick Ludlam Co	New York City	2	2	....	2	....	....	....	....	....	....
Mapes F. & P. Guano Co	New York City	6	7	3	1	....	3	....	3	....	....
Martin Fertilizer Co	Philadelphia, Pa.	7	7	1	2	3	2	....	3	1	....
Monmouth County Farmers Exchange	Freehold, N. J.	6	7	4	1	....	2	....	2	....	....
J. R. Moore	Swedesboro, N. J.	7	7	4	3	....	....	....	....	....	....
Nassau Fertilizer Co	New York City	6	6	3	3	....	....	....	....	....	....
Albert Nelson	Allentown, N. J.	6	8	1	5	....	2	....	2	....	....
Patapsco Guano Co	Baltimore, Md.	2	2	...	2	....	....	....	....	....	....
Philadelphia Guano Works	Philadelphia, Pa.	3	7	3	3	....	1	....	1	....	....
Rasin-Monumental Co	Baltimore, Md.	10	12	1	9	2	....	....	2	....	....
Reading Bone Fertilizer Co	Reading, Pa.	2	2	1	1	....	....	....	....	....	....
Reading Chemical Co	Reading, Pa.	3	3	1	1	1	....	....	1	....	....
Ellwood Roberts Co	Philadelphia, Pa.	1	1	....	1	....	....	....	....	....	....
F. S. Ryster Guano Co.	Baltimore, Md.	13	15	2	10	2	1	....	3	....	....
Ruckman Bros	New Bruns'k, N. J.	2	2	1	1	....	....	....	....	....	....
Schanck, Hutchinson & Field	Hightstown, N. J.	3	3	....	2	1	....	....	1	....	....
Scott Fertilizer Co	Elkton, Md.	6	7	2	3	1	1	....	2	....	....
M. L. Shoemaker & Co, Inc	Philadelphia, Pa.	2	2	1	....	1	....	....	1	....	....
Harry L. Sickel	Woodbury, N. J.	4	4	1	2	1	....	....	1	....	....
South Jersey Farmers Exchange	Woodstown, N. J.	22	26	5	14	4	1	2	7	....	....
Standard Guano Co	Baltimore, Md.	5	5	....	2	3	....	....	3	....	....
Swift & Co	Baltimore, Md.	8	9	1	4	1	2	....	4	....	....
Swift & Co	Kearney, N. J.	24	26	3	8	9	7	1	13	2	....
Taylor Bros	Camden, N. J.	2	2	1	1	....	....	....	....	....	....

* Not over 0.2% low in nitrogen, 0.3% low in phosphoric acid and potash.

Summary of the Results Obtained with the Mixed Fertilizers Examined During the Inspection of 1918

Manufacturer	Address	Number of Brands Received	Number of Samples Examined	Number of Samples Satisfied Guarantees	Number of Samples Substantially Satisfied Guarantees*	Number of Samples Deficient in— Nitrogen	Phosphoric Acid	Potash	One Element	Two Elements	Three Elements
I. P. Thomas & Son Co.	Philadelphia, Pa.	17	19	7	7	2	3	....	5	....	....
Trenton Bone Fertilizer Co.	Trenton, N. J.	9	11	2	7	2	....	....	2	....	....
F. W. Tunnell & Co., Inc.	Philadelphia, Pa.	26	31	12	12	3	4	....	7	....	....
J. E. Tygert Co.	Philadelphia, Pa.	8	8	1	5	1	1	....	2	....	....
Virginia-Carolina Chemical Co.	New York City	12	17	3	11	....	2	1	3	....	....
West Jersey Marl & Transportation Co.	Woodbury, N. J.	11	11	3	7	....	....	1	1	....	....
J. R. Wyckoff	Princeton Jct., N. J.	6	6	....	3	3	1	....	2	1	....

* Not over 0.2% low in nitrogen, 0.3% low in phosphoric acid and potash.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen, Phosphoric Acid and Potash

Station Number	Manufacturer and Brand	Where Sampled
	American Agricultural Chemical Co., New York City.	
180272	Bradley's Unicorn, 1916	Belvidere
180271	Bradley's New Method Fertilizer, 1916	Belvidere
180341	East India Unexecelled Fertilizer, 1916	Monmouth Junction
180276	Wheeler's Wheat Grower, 1916	Lebanon
180314	Williams & Clark's Special Prolific Crop Producer	Dayton
	Baltimore Pulverizing Co., Baltimore, Md.	
18053	*Corn and Grain Grower	Mt. Holly
18787	*Corn and Grain Grower	Mt. Holly
	Baugh & Sons Co., Philadelphia, Pa.	
180319	Baugh's General Crop Grower for All Crops	Dayton
	Bowker Fertilizer Co., New York City.	
180288	Bowker's Staple Phosphate, 1916	North Branch
	Consumers Chemical Corporation, New York City.	
180326	Consumers Pure-Sure Plant Food	Titusville
	Listers Agricultural Chemical Works, Newark, N. J.	
180298	Listers Special Crop Producer, 1916	Three Bridges
180300	Listers Ammoniated Dissolved Superphosphate, 1916	Far Hills
180302	Listers Standard Pure Superphosphate of Lime, 1916	Far Hills
	Scott Fertilizer Co., Elkton, Md.	
180303	*Scott's Soluble Phosphate, 12 and 2	Baptistown
	I. P. Thomas & Son Co., Philadelphia, Pa.	
180357	Thomas' 4-8-4	Westville
	F. W. Tunnell & Co., Inc., Philadelphia, Pa.	
18076	*1012 Mixture	Beverly
18246	*1013 Mixture	Blackwood

* Nitrogen not guaranteed.

Commercial Fertilizers

Furnishing Nitrogen, Phosphoric Acid and Potash

Nitrogen						Phosphoric Acid							Potash	
											Available			
As Nitrates	As Ammonia Salts	As Soluble Organic Matter	As Insoluble Organic Matter	Total Found	Total Guaranteed	Soluble in Water	Soluble in Ammonium Citrate	Insoluble	Total Found	Total Guaranteed	Found	Guaranteed	Found	Guaranteed
0.51	0.28	0.14	0.72	1.65	1.65	4.90	4.68	1.53	11.11	10.00	9.58	9.00	1.02	1.00
Tr.	0.16	0.18	0.39	0.73	0.82	1.94	5.58	2.51	10.03	9.00	7.52	8.00	0.91	1.00
0.51	0.67	0.22	0.62	2.02	2.06	4.90	3.73	2.01	10.64	9.00	8.63	8.00	0.94	1.00
Tr.	0.12	0.21	0.31	0.64	0.82	3.02	5 78	2.24	11.04	9.00	8.80	8.00	0.86	1.00
0.19	0.14	0.03	0.35	0.71	0.82	1.96	5.77	2.17	9.90	9.00	7.73	8.00	0.82	1.00
.....	.....	.....	.....	.....	.....	1.06	7.35	2.67	11.08	12.00	8.41	12.00	1.12	1.00
.....	.....	.....	.....	.....	.....	0.38	7.33	3.06	10.77	12.00	7.71	12.00	0.98	1.00
.....	0.18	0.26	[1]0.50	0.94	0.82	5.54	2.27	1.46	9.27	8.00	7.81	8.00	1.25	1.00
Tr.	0.11	0.26	0.35	0.72	0.82	1.40	5.66	2.58	9.64	9.00	7.06	8.00	0.88	1.00
.....	0.36	0.19	0.51	1.06	0.82	5.36	3.22	1.65	10.23	9.00	8.58	8.00	1.02	1.00
0.29	0.05	0.25	0.29	0.88	0.82	7.16	1.89	1.46	10.51	9.00	9.05	8.00	1.18	1.00
.....	0.25	0.61	[2]1.12	1.98	2.06	6.72	1.52	2.30	10.54	9.00	8.24	8.00	1.19	1.00
Tr.	0.91	0.57	[2]0.96	2.44	2.47	7.94	1.71	1.84	11.49	10.00	9.65	9.00	1.31	1.00
.....	.....	.....	.....	.....	.....	7.80	4.39	0.87	13.06	.....	12.19	12.00	2.05	2.00
0.86	1.13	0.39	0.72	3.10	3.25	2.40	5.91	2.08	10.39	8.50	8.31	8.00	3.70	4.00
Tr.	0.35	0.13	0.34	0.82	.....	0.80	7.53	2.57	10.90	11.00	8.33	10.00	*0.92	1.00
Tr.	.....	0.05	0.17	0.22	.....	1.90	8.11	1.19	11.20	11.00	10.01	10.00	*0.79	1.00

* Potash largely, if not entirely, from sulphate.

[1] Insoluble organic nitrogen of inferior quality. Excess of total nitrogen partially offsets amount of inferior quality.

[2] Insoluble organic nitrogen of inferior quality.

COMMERCIAL FERTILIZERS
Furnishing Nitrogen and Phosphoric Acid

Station Number	Manufacturer and Brand	Where Sampled
	American Agricultural Chemical Co., New York City.	
180269	Soluble Grain Mixture	Belvidere
180273	Bradley's Golden Crop Compound	Belvidere
180277	Bradley's Special Superior Compound, Revised	Neshanic
180312	East India Special Improved Compound	Hightstown
180313	Read's Practical Grain Grower	Hightstown
180315	Williams & Clark's Sterling Mixture	Dayton
	American Fertilizing Co., Baltimore, Md.	
180263	American Fish Special	Salem
	Baugh & Sons Co., Philadelphia, Pa.	
180266	Baugh's The Old Stand-by Dissolved Animal Base	Belle Mead
180267	Baugh's Wheat Fertilizer for Wheat and Grass	Belle Mead
180268	Baugh's Half and Half Mixture	Belle Mead
180281	Baugh's Truckers' Favorite	Pittstown
180317	Baugh's Corn and Oats Fertilizer	Burlington
180318	Baugh's Peninsula Grain Producer	Dayton
	The Berg Co., Philadelphia, Pa.	
180283	Berg's Special Bone Manure	Flemington
180284	Berg's Special Wheat Grower	Flemington
180285	Berg's Animal Meat and Bone	Flemington
180286	Berg's Special Truck Grower	Flemington
	Bowker Fertilizer Co., New York City.	
180287	Bowker's Superphosphate with Ammonia 1%	North Branch
180290	Bowker's Superphosphate with Ammonia 2%	Somerville
	Coe-Mortimer Co., New York City.	
180321	E. Frank Coe's Original Ammoniated Dissolved Phosphate, 1916	Hopewell
18032[illegible]	E. Frank Coe's XXV Ammoniated Phosphate, 1916	Hopewell
18032[illegible]	E. Frank Coe's H. G. Ammoniated Superphosphate, 1916	Hopewell
	Consumers Chemical Corporation, New York City.	
180261	Consumers Pure-Sure Corn and Vegetable (without Potash)	Salem
180323	Consumers Pure-Sure Ammoniated Bone Phosphate	Titusville
180324	Consumers All Crop Compound (without Potash)	Titusville
180327	Consumers Pure-Sure Corn and Grain Bone Phosphate	Titusville
	Jas. G. Downward Co., Coatesville, Pa.	
180328	Ammoniated Phosphate	Trenton

Commercial Fertilizers

Furnishing Nitrogen and Phosphoric Acid

Nitrogen						Phosphoric Acid						
											Available	
As Nitrates	As Ammonia Salts	As Soluble Organic Matter	As Insoluble Organic Matter	Total Found	Total Guaranteed	Soluble in Water	Soluble in Ammonium Citrate	Insoluble	Total Found	Total Guaranteed	Found	Guaranteed
.....	0.02	0.29	[1]0.46	0.77	0.82	6.06	2.69	1.21	9.96	9.00	8.75	8.00
0.78	0.39	0.23	0.99	2.39	2.47	6.86	3.93	1.14	11.93	11.00	10.79	10.00
0.53	0.06	0.20	[1]0.70	1.49	1.65	7.24	2.97	1.64	11.85	11.00	10.21	10.00
0.61	0.05	0.21	0.63	1.50	1.65	5.84	5.10	1.33	12.27	11.00	10.94	10.00
0.48	0.11	0.46	0.60	1.65	1.65	6.80	3.59	1.76	12.15	11.00	10.39	10.00
0.46	0.05	0.33	[1]0.63	1.47	1.65	5.74	4.64	1.61	11.99	11.00	10.38	10.00
.....	0.02	0.51	1.10	1.63	1.65	8.46	3.64	1.34	13.44	12.00	12.10	11.00
.....	0.93	0.20	[1]0.37	1.50	1.65	9.22	2.03	0.77	12.02	12.00	11.25	12.00
.....	0.56	0.48	[1]0.50	1.54	1.65	8.00	2.05	1.18	11.23	10.00	10.05	10.00
.....	0.02	0.28	0.84	1.14	1.23	3.64	7.28	7.46	19.38	19.00	11.92	12.00
.....	1.36	0.35	[1]0.59	2.30	2.47	8.66	1.67	1.09	11.42	10.00	10.33	10.00
.....	0.60	0.42	[1]0.58	1.60	1.65	8.06	2.29	1.43	11.78	10.00	10.35	10.00
.....	0.07	0.47	[2]0.49	1.03	0.82	6.60	2.52	0.81	9.93	9.00	9.12	9.00
0.67	0.03	0.70	1.39	2.79	2.00	4.04	4.17	7.07	15.28	11.00	8.21	7.00
Tr.	0.03	0.52	[2]1.12	1.67	1.65	4.94	2.76	5.56	13.26	11.00	7.70	8.00
1.36	0.07	0.53	1.51	3.47	3.30	3.44	5.64	9.37	18.45	17.00	9.08	.....
1.02	0.04	0.46	1.05	2.57	2.47	6.50	3.82	5.02	15.34	.....	10.32	10.00
.....	0.03	0.20	[2]0.65	0.88	0.82	6.66	3.84	0.94	11.44	11.00	10.50	10.00
0.53	0.06	0.22	0.71	1.52	1.65	6.86	4.06	1.45	12.37	11.00	10.92	10.00
0.60	0.06	0.18	0.65	1.49	1.65	5.80	4.73	1.53	12.06	11.00	10.53	10.00
.....	0.01	0.22	0.57	0.80	0.82	6.84	3.58	1.13	11.55	11.00	10.42	10.00
0.72	0.34	0.30	0.85	2.21	2.47	7.44	3.01	1.39	11.84	11.00	10.45	10.00
.....	1.56	0.06	0.89	2.51	2.47	6.02	4.04	1.13	11.19	11.00	10.06	10.00
.....	0.08	0.56	1.01	1.65	1.65	5.84	4.69	1.40	11.93	11.00	10.53	10.00
.....	0.03	0.26	0.61	0.90	0.82	6.92	3.52	1.83	12.27	10.00	10.44	9.00
.....	0.28	0.49	1.08	1.85	1.65	8.10	4.62	0.85	13.57	13.00	12.72	12.00
.....	0.01	0.02	0.15	0.18	0.82	2.20	5.32	1.10	8.62	11.00	7.52	10.00

[1] Insoluble organic nitrogen of inferior quality.

[2] Insoluble organic nitrogen of inferior quality. Excess of total nitrogen partially offsets amount of inferior quality.

COMMERCIAL FERTILIZERS
Furnishing Nitrogen and Phosphoric Acid

Station Number	Manufacturer and Brand	Where Sampled
	Hendrickson & Dilatush, Robbinsville, N. J.	
180329	Grain and Grass Manure No. 2	Robbinsville
	Listers Agricultural Works, Newark, N. J.	
180301	Listers Crescent Ammoniated Superphosphate, 1916	Far Hills
	Mapes Formula & Peruvian Guano Co., New York City.	
180275	Mapes' General Crop, 1916 Brand	Chester
	Monmouth County Farmers Exchange, Freehold, N. J.	
180330	Triangle Brand 2-11	Hightstown
	Albert Nelson, Allentown, N. J.	
180334	Nelson's Special R and W Guano	Nelsonville
180332	Nelson's Special G and G Guano	Nelsonville
	Philadelphia Guano Works, Philadelphia, Pa.	
180291	1918 Grain Superphosphate	Bound Brook
180363	1918 Grain Superphosphate	Belle Mead
180349	1918 Corn and Vegetable Manure	Monmouth Junction
180364	1918 Corn and Vegetable Manure	Belle Mead
180350	1918 Wheat and Grass Grower	Monmouth Junction
	Rasin-Monumental Co., Baltimore, Md.	
180295	Rasin's Special Fish Guano	North Branch
180297	Rasin's Special Fish Mixture	North Branch
	Scott Fertilizer Co., Elkton, Md.	
180304	Scott's Ammoniated Base	Frenchtown
	South Jersey Farmers Exchange, Woodstown, N. J.	
180362	Exchange Brand Grain and Grass Fertilizer	Bridgeton
180352	Wheat and Grass Fertilizer	Woodstown
	Swift & Co., Kearney, N. J.	
180353	Holly Special Harrison Formula Fertilizer	Mt. Holly
180354	Swift's Special Corn Grower	Mt. Holly
180355	Holly Special Diamond A Fertilizer	Mt. Holly
180356	Swift Pure Truck and Potato Fertilizer	Mt. Holly
	I. P. Thomas & Son Co., Philadelphia, Pa.	
180306	Thomas' Triumph Manure	Barbertown
180307	Raw and Acidulated Bone	Barbertown
	Trenton Bone Fertilizer Co., Trenton, N. J.	
180339	Bone and Tankage	Pennington
180310	Special Grain	Lambervtille

Commercial Fertilizers
Furnishing Nitrogen and Phosphoric Acid

Nitrogen						Phosphoric Acid						
											Available	
As Nitrates	As Ammonia Salts	As Soluble Organic Matter	As Insoluble Organic Matter	Total Found	Total Guaranteed	Soluble in Water	Soluble in Ammonium Citrate	Insoluble	Total Found	Total Guaranteed	Found	Guaranteed
Tr.	0.06	0.45	1.07	1.58	1.65	7.88	3.35	1.60	12.83	11.00	11.23	9.00
.....	0.13	0.65	0.72	1.50	1.65	8.18	2.39	2.31	12.88	11.00	10.57	10.00
0.78	0.01	0.21	[1]0.48	1.48	1.65	0.80	4.90	6.20	11.90	10.00	5.70	8.00
0.41	0.05	0.59	0.73	1.78	1.64	5.32	4.97	4.37	14.66	12.00	10.29	11.00
.....	0.03	0.42	0.27	0.72	0.82	5.10	4.05	1.70	10.85	10.00	9.15	9.00
.....	1.00	0.47	0.43	1.90	1.65	8.24	3.24	1.96	13.44	11.00	11.48	10.00
.....	0.33	0.23	[2]0.48	1.04	0.82	8.80	4.18	1.00	13.98	13.00	12.98	12.00
.....	0.10	0.25	0.42	0.77	0.82	9.60	3.02	0.51	13.13	13.00	12.62	12.00
.....	0.95	0.09	0.61	1.65	1.64	8.18	3.43	0.87	12.48	11.00	11.61	10.00
.....	0.75	0.48	0.36	1.59	1.64	7.92	3.19	0.78	11.89	11.00	11.11	10.00
.....	0.03	0.19	[2]0.64	0.86	0.82	2.62	7.34	1.50	11.46	10.00	9.96	9.00
.....	0.07	0.89	0.77	1.73	1.65	7.82	4.20	1.96	13.98	12.00	12.02	11.00
.....	0.04	0.41	[1]0.30	0.75	0.82	8.38	2.34	1.23	11.95	11.00	10.72	10.00
Tr.	0.33	0.46	0.96	1.75	1.65	8.24	3.95	1.28	13.47	14.00	12.19	12.00
0.37	0.03	0.37	0.84	1.61	1.65	6.84	3.38	3.90	14.12	10.50	10.22	10.00
.....	0.06	0.58	1.10	1.74	1.65	5.74	4.87	5.92	16.53	.....	10.61	10.00
0.77	0.13	0.31	1.99	3.20	3.29	5.14	4.34	0.72	10.20	10.00	9.48	10.00
0.64	0.28	0.11	0.64	1.67	1.65	6.94	3.59	0.69	11.22	10.00	10.53	10.00
1.09	0.07	0.08	1.25	2.49	2.47	3.90	3.95	0.73	8.58	8.00	7.85	8.00
1.19	1.13	0.47	0.35	3.14	3.29	3.34	4.64	1.12	9.10	10.00	7.98	10.00
....	0.08	0.34	[2]0.42	0.84	0.82	7.56	4.31	1.37	13.24	10.50	11.87	10.00
....	0.01	0.03	1.72	1.76	1.65	3.46	6.44	9.90	19.80	17.00	9.90	.....
....	0.15	1.12	[1]0.85	2.12	2.06	2.44	5.27	6.28	13.99	9.00	7.71	8.00
....	0.06	0.75	[1]0.64	1.45	1.64	3.66	5.21	1.70	10.57	10.00	8.87	9.00

[1] Insoluble organic nitrogen of inferior quality.

[2] Insoluble organic nitrogen of inferior quality. Excess of total nitrogen partially offsets amount of inferior quality.

COMMERCIAL FERTILIZERS

Furnishing Nitrogen and Phosphoric Acid

Station Number	Manufacturer and Brand	Where Sampled
	F. W. Tunnell & Co., Inc., Philadelphia, Pa.	
180335	Grain Manure	Titusville
180336	1918 Fish Manure	Titusville
180338	1918 Raw and Acidulated Animal Compound	Titusville
180359	Wheat Grower	Bridgeton
18126	*Pea Manure	Beverly
	Virginia-Carolina Chemical Co., New York City.	
180361	V. C. C. Co.'s Ammoniated Bone Phosphate for All Crops	Jamesburg
180367	V. C. C. Co.s Ammoniated Bone Phosphate for All Crops	Belle Mead
180366	V. C. C. Co.'s H. G. Ammoniated Bone Phosphate	Belle Mead

* Nitrogen not guaranteed.

HUMUS AND MANURES

	American Agricultural Chemical Co., New York City.	
180176	Pulverized Sheep Manure	Morristown
	Armour Fertilizer Works, Baltimore, Md., and Chrome, N. J.	
18362	Armour's Sheep Manure	Merchantville
	M. B. Atkinson, Bogota, N. J.	
180113	Atkinson's Prepared Humus	Englewood
	Darling & Co., Chicago, Ill.	
180248	Darling's Sheep Manure	East Orange
	Godfrey Co-operative Fert. & Chem. Co., Newark, N. J.	
180198	Godfrey's Sheep Manure	Plainfield
	Hudson Carbon Co., Ballston Spa, N. Y.	
18952	Davidage's Concentrated Manure	Bound Brook
	H. B. Kemp, Long Branch, N. J.	
18882	Kemp's Pulverized Sheep Manure	Long Branch
	Natural Guano Co., Aurora, Ill.	
180132	Sheepshead Brand Pulverized Sheep Manure	Paterson
	New York Stable Manure Co., Jersey City, N. J.	
18876	Diamond Brand Compost—Well Rotted Horse Manure	Monmouth Junction
	Swift & Co., Kearny, N. J.	
18307	Swift's Pulverized Sheep Manure	Pitman

Commercial Fertilizers

Furnishing Nitrogen and Phosphoric Acid

Nitrogen						Phosphoric Acid						
											Available	
As Nitrates	As Ammonia Salts	As Soluble Organic Matter	As Insoluble Organic Matter	Total Found	Total Guaranteed	Soluble in Water	Soluble in Ammonium Citrate	Insoluble	Total Found	Total Guaranteed	Found	Guaranteed
.....	0.11	0.33	[1]0.52	0.96	0.82	9.04	3.61	0.77	13.42	13.00	12.65	12.00
.....	0.86	0.22	[1]0.64	1.72	1.64	7.06	3.61	0.81	11.48	11.00	10.67	10.00
.....	0.55	0.64	0.85	2.04	1.64	5.18	5.08	5.69	15.95	15.00	10.26	10.00
.....	0.13	0.04	[1]0.53	0.70	0.82	1.26	8.73	1.51	11.50	10.00	9.99	9.00
.....	0.06	0.18	0.30	0.54	....	5.28	6.25	1.09	12.62	.....	11.53	10.00
.....	0.47	0.14	[2]0.94	1.55	1.65	5.68	4.75	2.16	12.59	11.00	10.43	10.00
Tr.	0.08	0.89	0.72	1.69	1.65	5.96	3.96	1.73	11.65	11.00	9.92	10.00
.....	0.09	0.75	1.16	2.00	1.65	8.14	4.50	1.59	14.23	13.00	12.64	12.00

[1] Insoluble organic nitrogen of inferior quality. Excess of total nitrogen partially offsets amount of inferior quality.

[2] Insoluble organic nitrogen of inferior quality.

Humus and Manures

.....	.....	0.49	[1]1.86	2.35	2.06	0.32	1.49	0.56	2.37	1.25	1.81	.....	2.06	1.00
.....	.....	0.40	[1]1.32	1.72	1.65	0.06	0.94	0.10	1.10	1.00	1.00	.....	3.95	3.25
.....	.....	0.22	[2]0.80	1.02	1.25	0.16	0.15	0.17	0.48	1.00	0.31	.....	....	.....
.....	.....	0.45	[1]1.95	2.40	2.06	0.46	1.20	0.96	2.62	1.00	1.66	.....	1.32	1.00
....	.....	0.29	[2]1.28	1.57	1.65	0.32	0.61	0.12	1.05	1.00	0.93	.....	3.39	3.25
.....	.....	0.59	[1]0.75	1.34	1.00	0.20	4.90	7.53	12.63	1.00	5.10	.....	1.68	....
.....	.....	0.34	[1]1.72	2.06	1.65	0.28	1.25	0.15	1.68	1.00	1.53	.....	2.70	1.50
.....	0.46	0.48	[1]1.81	2.75	2.25	1.70	0.72	0.11	2.53	1.25	2.42	1.00	2.23	1.50
.....	.....	0.26	[1]1.96	2.22	2.06	0.54	1.22	0.46	2.22	1.79	1.76	1.50	0.90	1.00
.....	.....	0.12	[2]1.23	1.35	1.65	0.40	1.01	0.37	1.78	1.00	1.41	.....	1.90	1.50

[1] Insoluble organic nitrogen of inferior quality. Excess of total nitrogen partially offsets quantity of inferior quality.

[2] Insoluble organic nitrogen of inferior quality.

GROUND BONE

Station Number	Manufacturer and Brand	Where Sampled	Mechanical Analysis		Nitrogen		Phosphoric Acid	
			Finer than 1/50 inch	Coarser than 1/50 inch	Found	Guaranteed	Found	Guaranteed
	American Agricultural Chemical Co., New York City.							
180175	Fine Ground Bone	Morristown	42	58	2.73	2.47	22.08	22.88
18848	High Grade Ground Bone	Hightstown	63	37	3.56	3.29	21.70	20.59
	American Fertilizing Co., Baltimore, Md.							
18662	Bone Phosphate of Lime	Hammonton	71	29	3.61	3.29	23.82	20.64
	Armour Fertilizer Works, Baltimore, Md., and Chrome, N. J.							
18040	Armour's Bone Meal	Moorestown	64	36	2.11	2.47	28.10	22.00
18397	Armour's Raw Bone Meal	Salem	59	41	3.87	3.70	24.26	22.00
	Baugh & Sons Co., Philadelphia, Pa.							
18208	Baugh's Raw Bone Meal—Warranted Pure	Camden	55	45	3.59	3.30	22.16	20.50
18318	Baugh's Fine Ground Bone	Bridgeton	60	40	2.59	2.47	16.76	16.49
18380	Baugh's 3 and 50 Bone Meal	Bridgeton	59	41	2.40	2.47	26.36	22.88
	The Berg Co., Philadelphia, Pa.							
180054	Berg's Raw Bone—Fine	North Branch	54	46	3.26	3.00	22.22	22.00
	Bowker Fertilizer Co., New York City.							
18748	Bowker's Fresh Ground Bone	Matawan	50	50	2.61	2.47	24.66	22.88
	Chicago Feed & Fertilizer Co., Chicago, Ill.							
18598	Magic Steamed Bone Meal	Swedesboro	68	32	2.48	2.47	22.26	23.00
	Godfrey's Co-operative Fert. & Chem. Co., Newark, N. J.							
180195	Godfrey's Pure Bone Meal	Plainfield	54	46	2.79	2.47	24.34	23.00
	H. B. Kemp, Long Branch, N. J.							
18879	Kemp's Bone Meal	Long Branch	57	43	2.34	2.47	24.46	23.00
18880	Kemp's Raw Bone	Long Branch	27	73	3.76	3.70	25.00	21.50
	Listers Agricultural Works, Newark, N. J.							
18725	Listers Bone Meal, 1916	Lakewood	57	43	3.50	2.47	24.04	23.00

	Martin Fertilizer Co., Philadelphia, Pa.							
18775	Ground Bone	Moorestown	45	55	2.42	.....	25.14	.....
18254	Pure Raw Bone Meal	Blue Anchor	36	64	3.55	3.70	24.06	21.00
18683	Pure Ground Bone	Woodbine	66	34	2.29	2.47	23.10	22.99
	New Jersey Fertilizer & Chemical Co., New York City.							
180115	Bone Meal	Hackensack	63	37	1.40	1.65	30.22	28.00
	Raisin-Monumental Co., Baltimore, Md.							
18449	Ground Bone	Bridgeton	46	54	2.62	2.47	24.76	22.90
	Ellwood Roberts Co., Philadelphia, Pa.							
18634	Bone Meal	Winslow Junction	60	40	3.60	2.46	25.06	22.00
	F. S. Royster Guano Co., Baltimore, Md.							
18614	Pure Raw Bone Meal	Vineland	34	66	3.58	3.70	23.86	21.50
18618	Fine Ground Bone Meal	Vineland	58	42	2.57	2.47	24.20	22.90
	Ruckman Bros., New Brunswick, N. J.							
18932	Ground Bone	New Brunswick	49	51	2.39	2.47	22.24	20.00

GROUND BONE

Station Number	Manufacturer and Brand	Where Sampled	Mechanical Analysis: Finer than 1/50 inch	Mechanical Analysis: Coarser than 1/50 inch	Nitrogen: Found	Nitrogen: Guaranteed	Phosphoric Acid: Found	Phosphoric Acid: Guaranteed
	I. Serata & Son, Bridgeton, N. J.							
18320	Bone Meal	Bridgeton	67	33	2.57	2.47	23.76	22.88
	M. L. Shoemaker & Co., Inc., Philadelphia, Pa.							
18470	Swift-Sure Bone Meal	Cedarville	62	38	5.34	4.53	22.80	20.00
	South Jersey Farmers Exchange, Woodstown, N. J.							
18381	Bone Meal	Bridgeton	59	41	2.46	2.47	22.32	22.00
	Standard Guano Co., Baltimore, Md.							
18520	Bone Meal	Swedesboro	80	20	2.28	2.47	27.16	22.88
	Swift & Co., Baltimore, Md.							
180099	Swift's Bone Meal Fertilizer	Millington	63	37	4.59	2.47	21.80	24.00
	Swift & Co., Kearny, N. J.							
180098	Swift's Dessicated Bone Fertilizer	Millington	62	38	0.64	0.82	27.88	30.00
18172	Swift's Dessicated Bone Fertilizer	Fish House	58	42	1.43	0.82	29.36	30.00
18768	Swift's Steamed Bone Fertilizer	Red Bank	59	41	1.92	1.65	28.68	28.00
18730	Swift's Bone Meal	Red Bank	50	50	2.61	2.47	25.72	24.00
18875	Swift's Degelatinized Bone	Monmouth Junction	54	46	1.40	0.82	29.76	28.00
180233	Swift's Bone Meal Fertilizer	Madison	66	34	2.30	2.47	25.66	24.00
	J. P. Thomas & Son Co., Philadelphia, Pa.							
18699	Pure Ground Bone	Germania	56	44	2.50	2.46	26.71	23.00
	Trenton Bone Fertilizer Co., Trenton, N. J.							
18131	Trenton Pure Fine Ground Bone	Beverly	58	42	3.98	3.28	23.48	23.00
18441	Trenton Ground Steamed Bone	Bridgeton	74	26	2.18	2.46	28.76	23.00
	F. W. Tunnell & Co., Inc., Philadelphia, Pa.							
18467	Pure Ground Bone	Bridgeton	70	30	0.94	2.46	30.66	23.00
18423	Pure Raw Bone	Westville	54	46	3.20	3.30	24.82	20.00

	Virginia-Carolina Chemical Co., New York City.							
18743	V. C. C. Co.'s Bone Meal	Keyport	55	45	2.34	2.47	23.64	22.00
	Emil Wahl Manufacturing Co., Philadelphia, Pa.							
18465	Warranted Pure Phila, Button Bone Meal	Cedarville	88	12	3.65	3.75	26.02	25.00
	West Jerseey Marl & Trans. Co., Woodbury, N. J.							
18216	Pure Bone Meal	Glassboro	51	49	3.85	3.30	20.52	21.00
	Wm. Wilde, Vineland, N. J.							
18494	Ground Bone	Vineland	85	15	3.67	.....	25.90	.....
18500	Ground Steamed Bone	Vineland	82	18	3.74	.....	25.86	.....
	Winterbottom & Carter, Egg Harbor City, N. J.							
18702	Pure Bone Dust	Egg Harbor City	76	24	3.80	3.86	26.30	25.60

SUNDRY MATERIALS.

18058. Flue Dust. Submitted by Wm. Wilde, Vineland, N. J. It contained 5.95 per cent of water-soluble potash.

18102. Potash Salt. Sampled from the stock of the Monmouth County Farmers' Exchange, Freehold, N. J. It was guaranteed to contain 26.00 per cent of potash, and it was found to contain 22.47 per cent.

18280. Canadian Wood Ashes. Submitted by Duke Farms Co., Somerville, N. J. It contained 0.59 per cent of total phosphoric acid and 0.81 per cent of potash.

18409. Horn Shavings. Submitted by Garden State Orchard Co., Philadelphia, Pa. The sample consisted of 30 per cent of horn shavings and the balance was large pieces of horn. The sample contained 13.93 per cent of nitrogen.

18621. Ashes. Submitted by M. D. Lyons, Trenton, N. J., and contained 0.62 per cent of potash.

18624. Kelp Potash. Submitted by the Cedar Crest Orchard and Produce Co., Cedar Crest, N. J. It contained 40.75 per cent of potash.

18670. Alpha Potash Lime Fertilizer. Represented the stock of Eldredge & Phillips, Cape May, N. J., and was sold by the Alpha Portland Cement Co., Easton, Pa. It was guaranteed to contain 2.50 per cent of potash, and was found to contain 3.04 per cent of potash and 28.48 per cent of lime.

18678. Sewage Residue. Submitted by J. C. Stuart, Beverly, N. J. It contained 34.45 per cent of water; 0.94 per cent of nitrogen; 0.41 per cent of total phosphoric acid and 0.31 per cent of potash.

18757. Lime-Fertile. Submitted by Theo. Chamberlin, East Paterson, N. J., and was manufactured by The Fertile Chemical Co., Cleveland, O.

180035. Lime-Fertile. Taken from the stock of Ellis Tiger Co., Gladstone, N. J., and was manufactured by The Fertile Co., Cleveland, O.

	Lime		Magnesia		Total Phosphoric Acid	
	Found	Guarant'd	Found	Guarant'd	Found	Guarant'd
	%	%	%	%	%	%
Sample 18757	25.79	35.84	15.45	4.96	3.59	3.00
Sample 180035	27.13	35.84	16.98	4.96	2.55	3.00

18958. Marl. Submitted by Chas. Fraser, Marlton, N. J., and contained 6.41 per cent of total potash.

180109. Cocoanut Peelings. Submitted by Sharp and Street, Merchantville, N. J. The analysis showed it to contain the following: Water, 4.07 per cent; oil, 43.01 per cent; nitrogen, 1.34 per cent; total phosphoric acid, 0.46 per cent, and total potash, 0.42 per cent.

180216. Phoslime. Stock of Fanwood Lumber and Supply Co., Fanwood, N. J., and sold by Florida Soft Phosphate and Lime Co., Ocala, Fla. It contained 21.96 per cent of total phosphoric acid, and it was guaranted to contain 22.00 per cent.

180369. Nitrapo. Submitted by W. P. Hunt, Pennington, N. J. The

guarantee attached to the sample was nitrogen 15 per cent and potash 15 per cent. It contained nitrogen 14.13 per cent and potash 20.39 per cent.

180370. Bat Manure. Submitted by W. P. Hunt, Pennington, N. J. It contained nitrogen 0.04 per cent; total phosphoric acid 0.06 per cent and Potash 1.15 per cent.

180371. Horse Manure. Submitted by H. J. Appert & Son, Allendale, N. J.

180372. Horse Manure. Submitted by H. J. Appert & Son, Allendale, N. J.

	Sample 180371	Sample 180372
	%	%
Water	42.67	42.67
Nitrogen	0.56	0.61
Total Phosphoric Acid	0.33	0.24
Potash	0.50	0.50

180373. Green Sand Marl. Submitted by H. R. Cox, Berlin, N. J. It contained 4.96 per cent of total potash.

180374. Bat Guano. Submitted by The Elizabeth Nursery Co., Elizabeth, N. J.

180375. Bat Guano. Submitted by The Elizabeth Nursery Co., Elizabeth, N. J.

	Sample 180374	Sample 180375
	%	%
Nitrogen	0.96	0.62
Total Phosphoric Acid	19.74	10.55
Potash	0.60	0.34

AGRICULTURAL LIME

The law entitled "An Act to Regulate the Sale of Agricultural Lime" became effective on January 1, 1914. The essential features of this law, briefly stated, are:

1. Registration of the brand name and guarantees that will be attached to the materials as sold.
2. The constituents that must be guaranteed.
3. The name and address of the party responsible for the material.
4. The official inspection of the materials offered for sale.

Registrations

During the past year 35 manufacturers registered 70 different brands of agricultural lime. The names and addresses of those who have registered their products are:

Acme Lime Co., Inc.	Baltimore, Md.
American Agricultural Chemical Co.	New York City.
American Cyanamid Co.	New York City.
J. E. Baker Co.	York, Pa.
S. W. Barrick & Sons	Woodsboro, Md.
Beaver Dam Marble Co.	Cockeysville, Md.
Blair Limestone Co.	Martinsburg, W. Va.
Carbo Agricultural Lime Co.	Wilmington, Del.
Judson Conover	Matawan, N. J.
G. and W. H. Corson	Plymouth Meeting, Pa.
Dietrick Bros.	Reading, Pa.
Edison Pulverized Limestone Co.	New Village, N. J.
Fountain Rock Lime Co.	Woodsboro, Md.
M. J. Grove Lime Co.	Lime Kiln, Md.
J. B. King & Co.	New York City.
Knickenbocker Lime Co.	Philadelphia, Pa.
E. J. Lavino & Co.	Philadelphia, Pa.
LeGore Combination Lime Co.	LeGore, Md.
Weller C. Leigh	Lebanon, N. J.
John Meehan & Son	Philadelphia, Pa.
Merion Lime and Stone Co.	Norristown, Pa.
Michigan Limestone and Chemical Co., Inc.	Buffalo, N. Y.
M. C. Mulligan & Son	Clinton, N. J.
E. J. Neighbour	German Valley, N. J.
Palmer Lime and Cement Co.	New York City.
Philadelphia Lime Co., Inc.	Philadelphia, Pa.
C. T. Russell	Jersey City, N. J.
Security Cement and Lime Co.	Hagerstown, Md.
Standard Lime and Stone Co.	Baltimore, Md.
Standard Lime and Stone Co.	Buckeystown, Md.
Steacy & Wilton Co.	Wrightsville, Pa.
Tidewater Portland Cement Co.	Baltimore, Md.
Todd & Cordes	Peapack, N. J.
Twining & Large Co.	Carpentersville, N. J.
Charles Warner Co.	Wilmington, Del.

INSPECTION

The samples of lime products received consisted of burned limes, limestone, and refuse products.

The results secured by the analyses of 20 samples are given in the following tabulation. Several other unofficial samples were analyzed, but the results are not included because of the uncertainty as to whether they were representative of the products claimed.

Lime

Station Number	Manufacturer or Jobber and Brand	Place of Sampling	Total Lime Found	Total Lime Guaranteed	Total Magnesia Found	Total Magnesia Guaranteed	Lime and Magnesia in the form of Carbonates Found	Lime and Magnesia in the form of Carbonates Guaranteed
	American Cyananid Co., New York City.							
18871	Solime	Yardville	47.37	47–50	Tr.	1–2	31.00	33.00
	S. W. Barrick & Sons, Woodsboro, Md.							
18719	Hydrated Lime	Lakewood	55.93	56–60	5.72	2–5	19.92	0.50
	G. & W. H. Corson, Plymouth Meeting, Pa.							
18055	Corson's Prepared Lime	Moorestown	45.52	42–47	30.49	27–30	1.91	.....
	Dietrick Bros., Reading, Pa.							
18161	Gold Medal Brand Hydrated Lime	Delair	44.04	46–50	26.85	32–34	14.75	0–2
	M. J. Grove Lime Co., Lime Kiln, Md.							
18329	Hydrated Lime	Westville	47.92	.....	21.03	....	1.91	.....
	Legore Combination Lime Co., Legore, Md.							
18457	Refined Hydrated Lime	Quinton	57.42	50–75	6.78	1–5	5.26	1–5
18831	Refined Hydrated Lime	Marlboro	55.12	50–75	6.77	1–5	7.66	1–5
	Merion Lime & Stone Co., Norristown, Pa.							
18056	Hydrated Lime	Moorestown	46.42	45–55	31.21	30–35	4.76	5.00
	Palmer Lime & Cement Co., New York City.							
18262	Challenge Brand Hydrated Lime	Elmer	67.24	70.00	6.99	3.00	1.76	.....
	Philadelphia Lime Co., Inc., Philadelphia, Pa.							
18328	Hydrated Lime	Westville	48.90	46–50	31.33	32–34	1.76	0–2
	Standard Lime & Stone Co., Buckeyestown, Md.							
18513	Hydrated Lime	Swedesboro	70.20	70.00	Tr.	2.00	2.19	.....
	Steacy & Wilton Co., Wrightstown, Pa.							
18375	Sterling Brand Hydrated Lime	Bridgeton	64.82	68.20	6.14	6.52	6.55	1–5
	Chas. Warner Co., Wilmington, Del.							
18512	Cedar Hollow Limoid	Swedesboro	46.41	42–46	32.40	28–31	2.11	0–2
18721	Pulverized Burnt Lime	Lakewood	53.59	56–58	38.00	37–39	1.62	.....

LIMESTONE

Station Number	Manufacturer or Jobber and Brand	Place of Sampling	Total Lime		Total Magnesia		Lime and Magnesia in the form of Carbonates	
			Found	Guaranteed	Found	Guaranteed	Found	Guaranteed
	Beaver Dam Marble Co., Baltimore, Md.							
18021	Dolomitic Limestone	Vineland	28.66	....	20.34	.....	49.00	.....
	Edison Pulverized Limestone Co., New Village, N. J.							
18057	Edison's Pulverized Limestone	Moorestown	48.27	50.00	2.21	.....	50.48	.....
	Chas. Warner Co., Wilmington, Del.							
18829	Pulverized Limestone	Marlboro	29.77	29–30	21.50	19–20	51.27	.....

LIME BY-PRODUCTS (Unofficial Samples)

Station Number	Manufacturer or Jobber and Brand	Place of Sampling	Total Lime Found	Total Lime Guaranteed	Total Magnesia Found	Total Magnesia Guaranteed	Lime and Magnesia in the form of Carbonates Found	Lime and Magnesia in the form of Carbonates Guaranteed
18717	[1]By-Product from Acetylene Gas	Three Bridges	38.11	.....	Tr.	.....	21.70	.....
180042	[2]By-Product from Acetylene Gas	Trenton	36.23	.....	Tr.	.....	18.86	.....
18758	[3]By-Product from Presto-Lite	Elizabeth	40.70	.....	Tr.	.....	16.01	.....

[1] Water 32.92%
[2] Water 26.28%
[3] Water 32.62%

BRANDS REGISTERED FOR FISCAL YEAR ENDING OCTOBER, 31, 1918

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Water-Soluble Potash
Active Chemical Co., Camden, N. J.					
Semper Tankage Prepared	1.23	1.50	3.00	2.00	.....
Semper Soil Dresser	1.64	2.00	3.50	3.00	.....
Semper Peerless	0.82	1.00	11.00	10.00	1.00
Semper Vital	1.64	2.00	3.50	3.00	1.00
American Agricultural Chemical Co., New York, N. Y.					
Star Phosphate with Potash	.....	.....	11.00	10.00	1.00
Alkaline Grain Mixture	.....	.....	12.00	11.00	2.00
Peerless Special	1.65	2.00	9.00	8.00	.....
New Jersey Truck Manure	3.29	4.00	10.50	9.50	2.00
Moro-Phillips C. & G. Complete Fertilizer, 1916	0.82	1.00	9.00	8.00	1.00
Potomac Golden Harvest, Revised	2.47	3.00	11.00	10.00	.....
Potomac Top Dressing Manure	5.76	7.00	7.00	6.00	.....
Potomac Complete Manure, 1916	1.65	2.00	10.00	9.00	1.00
Potomac General Crop Compound, 1916	2.47	3.00	10.00	9.00	1.00
Potomac Golden Potato Manure	3.29	4.00	10.00	9.00	1.00
Potomac Odorless Lawn Manure	3.91	4.75	6.00	5.00	1.00
Potomac Special Truck Manure, 1916	4.11	5.00	9.00	8.00	1.00
Armour Fertilizer Works, Baltimore, Md.					
Harvest Queen, 1918	0.82	1.00	10.50	10.00	.....
Sweet Potato, 1918	1.23	1.50	9.50	9.00	.....
Blood and Meat, 1918	1.65	2.00	10.50	10.00	.....
Armours 3½-12-0	2.88	3.50	12.50	12.00	.....
Sterling Potato, 1918	0.82	1.00	7.50	7.00	1.00
Sheep Manure	1.65	2.00	1.00	.....	3.25
Baltimore Pulverizing Co., Baltimore, Md.					
Practical Fertilizer	0.82	1.00	9.00	8.00	.....
Baugh & Sons Co., Philadelphia, Pa.					
Baugh's Pure Steamed Bone	1.65	2.00	*25.00	.....	.....
Baugh's Wheat Fertlizer for Wheat and Grass	1.65	2.00	10.00	10.00	.....
Berg Co., Philadelphia, Pa.					
Ground Tankage	4.53	5.50	11.64	.....	.....
Berg's Special Wheat Grower	1.65	2.00	11.00	8.00	.....
Berg's Special Crop Grower	1.65	2.00	14.00	10.00	.....
Berg's Special Bone Manure Without Potash	2.00	2.43	11.00	7.00	.....
Berg's Special Truck Grower	2.47	3.00	14.00	10.00	.....
Berger Bros., Easton, Pa.					
Peerless Phosphate, 1916	0.82	1.00	9.00	8.00	.....
Lehigh Super Phosphate, 1916	1.65	2.00	11.00	10.00	.....
Bowker Fertilizer Co., New York, N. Y.					
Bowker's Fresh Ground Bone	2.47	3.00	22.88	.....	.....
Bowker's Corn Phosphate, 1916	1.65	2.00	11.00	10.00	1.00
Louis Burk, Philadelphia, Pa.					
Tankage	3.60	4.38	19.90	12.71	.....

BRANDS REGISTERED FOR FISCAL YEAR ENDING OCT. 31, 1918—Cont.

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Water-Soluble Potash
Central Chemical Co., Hagerstown, Md.					
C. C. C. Fine Ground Bone	2.87	3.50	23.00	.....	.....
C. C. C. Dissolved Phosphate	.....	.....	.....	16.00	.....
C. C. C. Truck Special	2.50	3.00	.....	10.00	.....
C. C. C. Potato Grower	3.29	4.00	.....	10.00	.....
C. C. C. Truckers Pride	4.11	5.00	.....	10.00	.....
C. C. C. Truckers Potash Special	1.65	2.00	.....	8.00	3.00
Chamberlin & Barclay, Cranbury, N. J.					
Chamberlin & Barclay's 1918 Special	3.28	4.00	8.00	6.00	3.00
Chicago Feed & Fertilizer Co., Chicago, Ill.					
Magic Steamed Bone Meal	2.47	3.00	23.00	.....	.....
Magic Brand Pulverized Sheep Manure	1.85	2.25	1.50	1.43	1.25
E. D. Chittenden Co., Bridgeport, Conn.					
Chittenden's Vegetable and Onion Grower without Potash	2.47	3.00	11.00	10.00	.....
Chittenden's Potato Special without Potash	3.30	4.00	11.00	10.00	.....
Chittenden's High Grade Potato without Potash	4.10	5.00	11.00	10.00	.....
Chittenden's Potato Special with 3 per cent Potash	3.30	4.00	9.00	8.00	3.00
Coe-Mortimer Co., New York, N. Y.					
Country Club (Regular U. S. Pat. Off.)	5.76	7.00	4.00	3.00	1.00
Golf and Lawn Fertilizer, 1916, Brand A, for Putting Greens	.....	.....	.....	.....	.....
Columbia Guano Co., Baltimore, Md.					
Columbia Phosphate and Potash Mixture	.....	.....	10.50	10.00	1.00
Columbia Reflex Ammoniated Superphosphate	0.82	1.00	10.50	10.00	.....
Columbia Vitalic Ammoniated Superphosphate	1.65	2.00	8.50	8.00	.....
J. S. Collins & Son, Inc., Moorestown, N. J.					
V C Special 3-10 Fertilizer	2.46	3.00	11.00	10.00	.....
V C Special 4-10 Fertilizer	3.29	4.00	11.00	10.00	.....
Armour's Sheep Manure Fertilizer	1.65	2.00	1.00	.....	3.00
Downing Phosphate Co., Brunswick, Ga.					
"Liberty Brand" Pulverized Untreated Phosphate.	.....	.....	31.50	.....	.....
Fertile Chemical Co., Cleveland, Ohio.					
Nitro-Fertile	2.00	2.40	3.00	3.00	3.00
J. Fischer & Co., Keyport, N. J.					
Nitrate of Soda Sweepings (Sifted)	10.00	.....	.....	.....	.....
Nitrate of Soda Sweepings	5.00	.....	.....	.....	.....
Godfrey Co-op. Fertilizer & Chemical Co., Newark, N. J.					
Godfrey's Sheep Manure	1.65	2.00	1.00	.....	3.25
G. G. Green, Jr., Woodbury, N. J.					
Pure Ground Bone	2.47	3.00	22.90	.....	.....
Joseph Gubbins, Philadelphia, Pa.					
"Liberty" Commercial Fertilizer No. 2	2.22	2.70	.....	.....	.....
"Liberty" Commercial Fertilizer No. 1	4.49	5.45	.....	.....	1.31

Brands Registered for Fiscal Year Ending Oct. 31, 1918—Cont.

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Water-Soluble Potash
Hendrickson & Dilatush, Robbinsville, N. J.					
Steam Bone	2.47	3.00	22.00	.....	.....
Grain Grass Manure No. 2	1.65	2.00	11.00	9.00	.....
H. G. Grain Grower	2.47	3.00	11.00	9.00	.....
Ferris Grass Manure No. 2½	7.38	9.00	7.00	5.00	.....
Heritage & Bro., Mullica Hill, N. J.					
Animal Tankage	4.90	6.00	12.00	.....	.....
Hubbard Fertilizer Co., Baltimore, Md.					
Hubbard's Farmers' I X L	1.64	2.00	9.00	8.00	2.00
Hutchinson & Rue, Windsor, N. J.					
Corn Mixture 1½-15	1.23	1.50	16.00	15.00	.....
International Agricultural Corporation, Buffalo, N. Y.					
Buffalo Sixteen Percent Acid Phosphate	.....	.....	17.00	16.00	.....
Buffalo Special Mixture No. 2	.....	.....	15.00	14.00	2.00
Buffalo Special Mixture No. 1	1.60	2.00	13.00	12.00	2.00
Keystone Bone Fertilizer Co., Inc., Philadelphia, Pa.					
1918 Keystone Sweet Potato Manure	1.65	2.00	9.00	8.00	2.00
A. R. Kohler, Westville, N. J.					
King Crab Meal	9.88	12.00	.....	.....	.....
William Lancaster, Philadelphia, Pa.					
Grange General Manure	0.82	1.00	13.00	12.00	.....
Grange E Brand Potato Manure	1.64	2.00	11.00	10.00	.....
Grange Superior Fish Manure	2.46	3.00	11.00	10.00	.....
Locke & Black, Swedesboro, N. J.					
Bone Tankage	3.70	4.50	20.00	.....	.....
Ground Tankage	5.14	6.25	8.00	.....	.....
Ground Tankage	6.25	7.60	11.00	.....	.....
Ground Tankage	6.58	8.00	11.00	.....	.....
Martin Fertilizer Co., Philadelphia, Pa.					
Martin's Nitrate of Soda	15.22	18.50	.....	.....	.....
Martin's Acid Phosphate 16 per cent	.....	.....	17.00	16.00	.....
Martin's Tankage 6 per cent	4.94	6.00	10.00	.....	.....
Martin's Tankage 8 per cent	6.58	8.00	10.00	.....	.....
Martin's Ammoniated Phosphate 2-8	1.65	2.00	9.00	8.00	.....
Martin's Ammoniated Phosphate 2-10	1.65	2.00	11.00	10.00	.....
Martin's Ammoniated Phosphate 3-8	2.47	3.00	9.00	8.00	.....
Martin's Ammoniated Phosphate 4-10	3.30	4.00	11.00	10.00	.....
Martin's Two Eight and Two 2-8-2	1.65	2.00	9.00	8.00	2.00
Martin's Three Eight and Three 3-8-3	2.47	3.00	9.00	8.00	3.00
Martin's Four Eight and Two 4-8-2	3.30	4.00	9.00	8.00	2.00

BRANDS REGISTERED FOR FISCAL YEAR ENDING OCT. 31, 1918—Cont.

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Water-Soluble Potash
Monmouth County Farmers Exchange, Freehold, N. J.					
Ground Dried Blood	12.96	15.75	.....	.....	.....
Ground Tankage	8.02	9.75	7.00	.....	.....
Triangle Brand 1-12-0	0.82	1.00	13.00	12.00	.....
Triangle Brand 2-11-0	1.64	2.00	12.00	11.00	.....
Triangle Brand 6-5-10-0	5.35	6.50	10.00	10.00	.....
Triangle Brand 8-6-0	6.58	8.00	7.00	6.00	.....
Triangle Brand 3-8-2	2.47	3.00	9.00	8.00	2.00
Triangle Brand 3-10-3	2.47	3.00	11.00	10.00	3.00
Joseph R. Moore, Swedesboro, N. J.					
J. R. Moore's 12 per cent King Crab	9.88	12.00	.....	.....	.....
J. R. Moore's 5½ per cent Tankage	4.53	5.50	15.00	.....	.....
J. R. Moore's 7 per cent Tankage	5.76	7.00	3.00	.....	.....
J. R. Moore's 8 per cent Tankage	6.59	8.00	5.00	4.00	.....
National Plant Food Co., Pensacola, Fla.					
Red Snapper	5.00	6.07	12.00	4.00	1.25
Nitrate Agencies Co., New York, N. Y.					
N. A. C. Brand Nitrapo	15.00	18.25	.....	.....	.....
Ground Dried Fish	8.22	10.00	5.57	.....	.....
Philadelphia Guano Works, Philadelphia, Pa.					
1918 Strawberry Mixture	3.30	4.00	11.00	10.00	.....
Potash Grain Manure	0.82	1.00	8.00	7.00	1.00
Reading Chemical Co., Reading, Penn.					
High Grade Phosphate	....	.....	17.00	16.00	.....
Royal Fish Guano	1.03	1.25	13.00	12.00	.....
Reading Soil Builder	1.64	2.00	11.00	10.00	.....
Pennant Winner	2.46	3.00	11.00	10.00	.....
F. S. Royster Guano Co., Baltimore, Md.					
Nitrate of Soda	15.00	18.24	.....	.....	.....
Royster's Fine Ground Bone Meal	2.47	3.00	22.90	.....	.....
Royster's Pure Raw Bone Meal	3.70	4.50	21.50	.....	.....
Royster's Grain and Grass Special	0.82	1.00	8.50	8.00	.....
Royster's Phosphate and Potash Mixture	.....	.....	12.50	12.00	2.00
Schanck, Hutchinson & Field, Hightstown, N. J.					
S. H. & F. Corn Mixture 2-8-0	1.65	2.00	9.00	8.00	.....
S. H. & F. Grain Mixture 2-8-0	1.65	2.00	9.00	8.00	.....
S. H. & F. Potato and Truck Manure 4-8-0	3.29	4.00	9.00	8.00	.....
S. H. & F. Potato and Vegetable Compound 4-10-0	3 29	4.00	11.00	10.00	.....
Special Fish Mixture for Potatoes with 2 per cent Potash 4-6-2	3.29	4.00	7.00	6.00	2.00
Davidson's Fish and Potato Mixture for Potatoes 4-8-3	3.29	4.00	9.00	8.00	3.00

Brands Registered for Fiscal Year Ending Oct. 31, 1918—Cont.

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Water-Soluble Potash
I. Serata & Sons, Bridgeton, N. J.					
Nitrate of Soda	15.58	19.00	.....	.....	.....
Truck Fertilizer	2.47	3.00	10.00	10.00	.....
Potato Fertilizer	3.29	4.00	10.00	10.00	.....
Top Dressing Fertilizer	4.12	5.00	10.00	10.00	.....
M. L. Shoemaker & Co., Inc., Philadelphia, Pa.					
Pure Raw Bone Meal	3.30	4.00	20.00	.....	.....
"Swift-Sure" Bone Meal	4.53	5.50	20.00	.....	.....
"Swift-Sure" Guano for Tomatoes, Truck and Corn	1.65	2.00	10.00	8.00	.....
"Swift-Sure" Phosphate for Tobacco and General Use	3.30	4.00	11.00	9.00	.....
South Jersey Farmers Exchange, Woodstown, N. J.					
South Jersey Farmers Exchange Brand 4-8-3	3.28	4.00	8.50	8.00	3.00
Special Fertilizers for Second Crop Cobblers	3.48	4.25	11.00	10.00	2.25
Standard Guano Co., Baltimore, Md.					
Standard's 2-10	1.64	2.00	10.50	10.00	.....
Grange Commercial Store Prize Winner Potato Manure	2.46	3.00	10.50	10.00	.....
Grange Commercial Store Mammoth Potato Manure	3.28	4.00	10.50	10.00	.....
Standard's 5-10	4.00	5.00	10.50	10.00	.....
Standard's 4-8-2	3.20	4.00	8.50	8.00	2.00
Standard's 4-8-3	3.28	4.00	8.50	8.00	3.00
Grange Commercial Store Special Potato Manure.	3.28	4.00	8.50	8.00	3.00
Swift & Co., Baltimore, Md.					
Swift's Jersey Sweet Potato Fertilizer	1.65	2.00	8.00	8.00	.....
Swift's General Crop Fertilizer	2.47	3.00	9.00	9.00	.....
Swift's Three Ten Naught Brand	2.47	3.00	10.00	10.00	.....
Swift's Special Pride of Jersey Fertilizer	4.11	5.00	8.00	8.00	.....
Swift's Special Phosphate and Potash	.....	.....	10.00	10.00	2.00
Swift's Wheat Grower Phosphate and Potash	.....	.....	12.00	12.00	2.00
Swift's Baltimore Formula	3.29	4.00	10.00	10.00	1.00
Swift's Four Ten Three Brand	3.29	4.00	10.00	10.00	3.00
Swift & Co., Kearny, N. J.					
Swift's Corn Grower	1.65	2.00	10.00	10.00	1.00
Swift's Special Fertilizer for Corn	2.88	3.50	12.00	12.00	.....
Swift's Special Fertilizer for Grass	6.58	8.00	6.00	6.00	.....
Taylor Bros., Camden, N. J.					
Taylor Brothers' Superior Ammoniated Super phate	1.65	2.00	8.00	8.00	1.00
Taylor Provision Co., Trenton, N. J.					
John Taylor's High Grade Potato Manure No. 1..	3.30	4.00	9.00	8.00	1.00

BRANDS REGISTERED FOR FISCAL YEAR ENDING OCT. 31, 1918—Cont.

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Water-Soluble Potash
F. W. Tunnell & Co., Inc., Philadelphia, Pa.					
Special Mixtures in accordance with ruling of State Chemist—					
Nitrate of Soda, 15 per cent	12.34	15.00	.....	.....	.....
Nitrate of Soda, 18 per cent	14.81	18.00	.....	.....	.....
Pea Manure	.....	.....	11.00	10.00	.....
1918 Corn Mixture	1.64	2.00	11.00	10.00	.....
1918 General Crop Grower	2.46	3.00	11.00	10.00	.....
Burlington Truck Manure	3.30	4.00	9.00	8.00	.....
High Grade Fish and Truck Guano	3.30	4.00	11.00	10.00	.....
1918 Truckers' Pride	3.30	4.00	11.00	10.00	.....
1918 Jersey Special	3.71	4.50	10.00	9.00	.....
7-8	5.77	7.00	9.00	8.00	.....
1918 10 per cent Top Dresser	8.23	10.00	4.00	.....	.....
Potash Grain Grower	0.82	1.00	8.00	7.00	1.00
Burlington County Potato Manure	3.30	4.00	8.00	7.00	1.00
Excelsior Potato Manure	3.30	4.00	9.00	8.00	4.00
Jacob R. Wyckoff, Princeton Junction, N. J.					
Wyckoff's Special Corn Grower	1.65	2.00	10.00	10.00	.....
Wyckoff's Clay Soil Special	1.65	2.00	12.00	12.00	.....
Wyckoff's Three Ten Naught	2.47	3.00	10.00	10.00	.....
Wyckoff's Special Formula	3.28	4.00	10.00	10.00	.....
Wyckoff's Special Harrison Formula	3.28	4.00	10.00	10.00	.....
Wyckoff's Special Potato Fertilizer	3.28	4.00	8.00	8.00	3.00
Wyckoff's Market Garden Manure	3.28	4.00	8.00	8.00	3.00
Wyckoff's Special Potato Manure	3.28	4.00	8.00	8.00	5.00

FERTILIZER REGISTRATIONS FOR 1919

NEW JERSEY
AGRICULTURAL
Experiment Stations

BULLETIN 335

NEW BRUNSWICK, N. J.

NEW JERSEY AGRICULTURAL EXPERIMENT STATIONS*

NEW BRUNSWICK, N. J.

STATE STATION. ESTABLISHED 1880

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*Staff list revised to January 1, 1919.

NEW JERSEY AGRICULTURAL EXPERIMENT STATION
DEPARTMENT OF AGRICULTURAL EXTENSION
ORGANIZED 1912

AND

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NORINE WEBSTER, Home Demonstration Agent for Bayonne.
HAROLD E. WETTYEN, B.SC., Demonstration Agent for Passaic County.
CAROLYN F. WETZEL, Home Demonstration Agent for Bergen County.
ALBERT E. WILKINSON, M.AGR., Demonstration Agent for Atlantic County.

New Jersey
Agricultural Experiment Stations

BULLETIN 335

JANUARY 30, 1919

Fertilizer Registrations for 1919

CHARLES S. CATHCART, *State Chemist*

The law entitled "An Act Concerning Fertilizers," which was approved March 27, 1912, requires the state chemist to publish annually a list of the brands of fertilizers that have been registered. In accordance with this requirement the following tabulations are presented. They contain all of the registrations of fertilizer materials and mixed fertilizers that have been received up to the date of this bulletin and which will be in force for the fiscal year ending October 31, 1919.

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
Acme Guano Co., Baltimore, Md.					
Nitrate of Soda,	14.76	18.00	.....	.....	.....
S. C. Phosphate,	.....	.....	.....	16.00	.....
Fish and Tankage,	3.28	4.00	4.00	.....	.....
Harvest King, No. 2,	0.82	1.00	11.00	10.00	.....
Ideal, No. 2,	1.64	2.00	9.00	8.00	.....
Ammoniated Fish Guano, No. 1,	2.46	3.00	9.00	8.00	.....
Perfect Potato,	3.28	4.00	9.00	8.00	.....
Acme Early Truck, No. 1,	4.10	5.00	8.00	7.00	.....
Special Sweet Potato, No. 2,	1.64	2.00	9.00	8.00	2.00
Fish Mixture, No. 2,	2.46	3.00	9.00	8.00	2.00
Willoughby's Mixture,	2.46	3.00	9.00	8.00	4.00
Potato Climax, No. 2,	3.28	4.00	9.00	8.00	2.00
1919 Potato Climax,	3.28	4.00	9.00	8.00	3.00
Acme Early Truck, No. 2,	4.10	5.00	8.00	7.00	2.00
Active Chemical Co., Camden, N. J.					
Semper Tankage,	3.69	4.50	8.00	.....	.....
Semper Corn Grower,	0.82	1.00	11.00	10.00	.....
Semper Soil Dresser,	1.64	2.00	3.50	3.00	.....
Semper All Crop,	1.64	2.00	9.00	8.00	.....
Semper Potato King,	1.64	2.00	11.00	10.00	.....
Semper Active,	2.46	3.00	9.00	8.00	.....
Semper Grain Royal,	2.46	3.00	11.00	10.00	.....
Semper Premium,	3.28	4.00	9.00	8.00	.....
Semper Special,	3.28	4.00	11.00	10.00	.....
Semper Condor,	4.10	5.00	9.00	8.00	.....
Semper Vim,	4.10	5.00	11.00	10.00	.....
Semper Peerless,	0.82	1.00	11.00	10.00	1.00
Semper Vigor,	1.64	2.00	9.00	8.00	2.00
Semper Excello,	1.64	2.00	11.00	10.00	1.00
Semper Versus,	2.46	3.00	9.00	8.00	3.00
Alpha Portland Cement Co., Easton, Pa.					
Alpha Potash Lime Fertilizer,	.....	.....	.....	.....	2.50
Alphano Humus Co., New York City.					
Prepared Alphano Humus,	1.25	1.50	.....	.....	.....
The American Agricultural Chemical Co., New York City.					
Nitrate of Soda,	15.00	18.23	.....	.....	.....
12% Acid Phosphate,	.....	.....	13.00	12.00	.....
Basic Lime Phosphate,	.....	.....	14.00	13.00	.....
14% Acid Phosphate,	.....	.....	15.00	14.00	.....
16% Acid Phosphate,	.....	.....	17.00	16.00	.....
Star Phosphate with Potash,	.....	.....	11.00	10.00	1.00
Dissolved Phosphate and Potash,	.....	.....	11.00	10.00	2.00

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
The American Ag'l Chemical Co., N. Y. City—Cont.					
Fine Ground Bone,	2.47	3.00	22.88	......	......
High Grade Ground Bone,	3.29	4.00	20.59	......	......
Soluble Grain Mixture,	0.82	1.00	9.00	8.00	......
Ammoniated Superphosphate,	0.82	1.00	9.00	8.00	......
Ammoniated Fertilizer A,	0.82	1.00	11.00	10.00	......
XXX Ammoniated Fertilizer,	1.23	1.50	11.00	10.00	......
Special Sweet Potato Fertilizer,	1.65	2.00	9.00	8.00	......
Peerless Special,	1.65	2.00	9.00	8.00	......
Ammoniated Fertilizer AA,	1.65	2.00	11.00	10.00	......
Special Potato Phosphate,	1.65	2.00	13.00	12.00	......
Homestead Good Grower,	2.06	2.50	9.00	8.00	......
Ammoniated Fertilizer AAA,	2.47	3.00	11.00	10.00	......
Superphosphate with Ammonia 4%,	3.29	4.00	9.00	8.00	......
Ammoniated Fertilizer AAAA,	3.29	4.00	11.00	10.00	......
High Grade Ammoniated Fertilizer,	4.11	5.00	9.00	8.00	......
Great Truck Special,	4.11	5.00	11.00	10.00	......
Sterling Truck and Top Dressing Mixture Revised	5.76	7.00	7.00	6.00	......
High Nitrate Mixture for Top Dressing,	8.23	10.00	6.00	5.00	......
Eagle Phosphate,	0.82	1.00	8.00	7.00	1.00
Royal Potash Mixture,	0.82	1.00	9.00	8.00	2.00
Wheat Corn and Grass Fertilizer,	0.82	1.00	10.00	9.00	1.00
Seeding Down Mixture,	0.82	1.00	11.00	10.00	1.00
All Crop Fish Guano, Revised,	0.82	1.00	11.00	10.00	1.00
All Crop Fish Guano,	1.23	1.50	11.00	10.00	1.00
Matchless Potash Manure,	1.65	2.00	9.00	8.00	2.00
General Crop Grower, 1916,	1.65	2.00	10.00	9.00	1.00
Soil and Crop Invigorator, Revised,	1.65	2.00	10.00	9.00	1.00
Gardners Delight, 1916,	2.47	3.00	10.00	9.00	1.00
Top Dresser for Cranberries, 1916,	2.47	3.00	10.00	9.00	1.00
Sure Growth Phosphate, 1916 (Sulphate),	2.47	3.00	10.00	9.00	1.00
Corn and Vegetable Compound,	2.47	3.00	10.00	9.00	1.00
Superior Fish Guano for Broadcasting,	3.29	4.00	6.00	5.00	1.00
Samson Potato and Truck Manure,	3.29	4.00	9.00	8.00	3.00
Complete Potato Mixture,	3.29	4.00	11.00	10.00	3.00
Odorless Grass and Lawn Top Dressing, Revised,	3.91	4.75	6.00	5.00	1.00
Truckers Best Fertilizer,	4.11	5.00	11.00	10.00	4.00
Special Grass and Garden Mixture, 1916,	8.23	10.00	6.00	5.00	1.00
Bradley's Special Superior Compound, Revised,	1.65	2.00	11.00	10.00	......
Bradley's Golden Crop Compound,	2.47	3.00	11.00	10.00	......
Bradley's Truckers' Delight,	3.29	4.00	11.00	10.00	......
Bradley's New Method Fertilizer, 1916,	0.82	1.00	9.00	8.00	1.00
Bradley's Eclipse Phosphate, 1916,	1.23	1.50	11.00	10.00	1.00
Bradley's Unicorn, 1916,	1.65	2.00	10.00	9.00	1.00

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
The American Ag'l Chemical Co., N. Y. City—Cont.					
Bradley's Patent Superphosphate, 1916,	2.06	2.50	9.00	8.00	1.00
Bradley's Half Century Fertilizer, 1916,	2.06	2.50	11.00	10.00	1.00
Bradley's Potato Manure, 1916,	2.47	3.00	10.00	9.00	1.00
Bradley's XL Superphosphate of Lime, 1916,	2.47	3.00	10.00	9.00	1.00
Bradley's Complete Manure for Potatoes and Vegetables, 1916,	3.29	4.00	10.00	9.00	1.00
Bradley's Peerless Potato Fertilizer,	3.29	4.00	11.00	10.00	3.00
Bradley's Golden Eagle, 1916,	4.11	5.00	9.00	8.00	1.00
Crocker's Special Grain Grower,	1.65	2.00	11.00	10.00	......
Crocker's Special Colonial Fertilizer, Revised,	2.47	3.00	11.00	10.00	......
Crocker's Champion Potato Grower,	3.29	4.00	11.00	10.00	......
Crocker's Universal Grain Grower, 1916,	0.82	1.00	9.00	8.00	1.00
Crocker's Complete Manure, 1916,	0.82	1.00	11.00	10.00	1.00
Crocker's New Rival Fertilizer, 1916,	1.23	1.50	11.00	10.00	1.00
Crocker's Harvest Jewel Fertilizer, 1916,	1.65	2.00	10.00	9.00	1.00
Crocker's High Grade Special, 1916,	1.65	2.00	11.00	10.00	1.00
Crocker's Special Potato Fertilizer, 1916,	3.29	4.00	10.00	9.00	1.00
Crocker's Special Potato and Cabbage Manure,	3.29	4.00	11.00	10.00	3.00
Crocker's Best Truck Manure, 1916,	4.11	5.00	9.00	8.00	1.00
East India Special Improved Compound,	1.65	2.00	11.00	10.00	......
East India Early Market,	2.47	3.00	11.00	10.00	......
East India Victor Special, 1916,	3.29	4.00	11.00	10.00	......
East India Economizer Phosphate, 1916,	0.82	1.00	9.00	8.00	1.00
East India Mayflower, 1916,	1.65	2.00	10.00	9.00	1.00
East India Corn King, 1916,	2.47	3.00	10.00	9.00	1.00
East India Potato Special,	3.29	4.00	9.00	8.00	3.00
East India Potato and Garden Manure,	3.29	4.00	10.00	9.00	1.00
East India Black Hawk Potato and Truck Fertilizer, 1919,	3.29	4.00	11.00	10.00	3.00
Great Eastern Dissolved Acid Phosphate,	......	......	15.00	14.00	......
Great Eastern General, 1916,	0.82	1.00	9.00	8.00	1.00
Great Eastern Special Crop Fertilizer, 1916,	0.82	1.00	11.00	10.00	1.00
Great Eastern High Grade Potato Fertilizer, 1916	1.65	2.00	11.00	10.00	1.00
Great Eastern Wheat Special, 1916,	2.06	2.50	9.00	8.00	1.00
Great Eastern Northern Corn Special, 1916,	2.06	2.50	9.00	8.00	1.00
Great Eastern Vegetable, Vine and Tobacco Fertilizer, 1916,	2.06	2.50	11.00	10.00	1.00
Great Eastern Tomato and Potato Special, 1916,	4.11	5.00	9.00	8.00	1.00
Milsom's Golden Eagle,	1.65	2.00	11.00	10.00	......
Milsom's Special Harrow Brand,	2.47	3.00	11.00	10.00	......
Milsom's Potato Producer,	3.29	4.00	11.00	10.00	......
Milsom's Wheat, Oats and Barley, 1916,	0.82	1.00	9.00	8.00	1.00
Milsom's Potato and Cabbage Manure, 1916,	0.82	1.00	11.00	10.00	1.00

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
The American Ag'l Chemical Co., N. Y. City—Cont.					
Milsom's Soil Enricher, 1916,	1.65	2.00	10.00	9.00	1.00
Milsom's Buffalo Fertilizer, 1916,	2.06	2.50	9.00	8.00	1.00
Milsom's Potato, Hop and Tobacco Fertilizer, 1916	2.06	2.50	11.00	10.00	1.00
Milsom's Corn Fertilizer, 1916,	2.47	3.00	10.00	9.00	1.00
Milsom's Medal Brand Manure, 1916,	3.29	4.00	10.00	9.00	1.00
Milsom's Truck Fertilizer, 1916,	3.70	4.50	9.00	8.00	1.00
Moro-Phillips' Farmers' Potato Mixture, 1916,	1.23	1.50	11.00	10.00	1.00
Moro-Phillips' Pure Phuine, 1916,	1.65	2.00	11.00	10.00	1.00
Moro-Phillips' Special No. 1 Potato and Truck Manure, 1916,	2.47	3.00	10.00	9.00	1.00
Moro-Phillips' High Grade Truck Manure, 1916,	3.29	4.00	10.00	9.00	1.00
North Western Complete Compound, 1916,	0.82	1.00	9.00	8.00	1.00
North Western Challenge Fertilizer, 1916,	0.82	1.00	11.00	10.00	1.00
North Western Farmers Standard, 1916,	1.23	1.50	11.00	10.00	1.00
North Western Shawnee Phosphate, 1916,	1.65	2.00	10.00	9.00	1.00
North Western Diamond Potash Mixture, 1916,	1.65	2.00	11.00	10.00	1.00
North Western Homestead Fertilizer, 1916,	2.06	2.50	9.00	8.00	1.00
North Western Red Line Fertilizer, 1916,	2.47	3.00	10.00	9.00	1.00
North Western Garden Manure, 1916,	3.29	4.00	10.00	9.00	1.00
Packer's Union Superior Acid Phosphate,	......	......	15.00	14.00	......
Packer's Union Universal Fertilizer, 1916,	0.82	1.00	9.00	8.00	1.00
Packer's Union Superior Crop Grower, 1916,	0.82	1.00	11.00	10.00	1.00
Packer's Union Animal Corn Fertilizer, 1916,	1.65	2.00	11.00	10.00	1.00
Packer's Union Potato Manure, 1916,	2.06	2.50	11.00	10.00	1.00
Potomac Fruit Tree Special,	1.65	2.00	13.00	12.00	......
Potomac Golden Harvest Revised,	2.47	3.00	11.00	10.00	......
Potomac Complete Manure, 1916,	1.65	2.00	10.00	9.00	1.00
Potomac Potato Special,	3.29	4.00	9.00	8.00	3.00
Potomac Golden Potato Manure,	3.29	4.00	10.00	9.00	1.00
Preston's Pioneer Fertilizer, 1916,	0.82	1.00	11.00	10.00	1.00
Preston's Corn, Tomato and Potato Guano, 1916,	1.65	2.00	10.00	9.00	1.00
Preston's Special New Jersey Brand, 1916,	2.47	3.00	10.00	9.00	1.00
Read's Practical Grain Grower,	1.65	2.00	11.00	10.00	......
Read's Farm and Garden Manure,	2.47	3.00	11.00	10.00	......
Read's Top Notch Mixture,	3.29	4.00	11.00	10.00	......
Read's Leader Fertilizer,	0.82	1.00	9.00	8.00	1.00
Read's All Crops Fertilizer, 1916,	0.82	1.00	11.00	10.00	1.00
Read's Corn, Wheat and Rye, 1916,	1.65	2.00	10.00	9.00	1.00
Read's Farmers' Friend Superphosphate, 1916,	2.06	2.50	9.00	8.00	1.00
Read's Vegetable and Vine Fertilizer, 1916,	2.47	3.00	10.00	9.00	1.00
Read's High Grade Farmers' Friend Superphosphate, 1916,	3.29	4.00	10.00	9.00	1.00
Read's Truck Fertilizer, 1916,	4.11	5.00	9.00	8.00	1.00

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
The American Ag'l Chemical Co., N. Y. City—Cont.					
Reese's Ammoniated Phosphate Mixture, 1916, ..	0.82	1.00	11.00	10.00	1.00
Reese's Potato Manure, 1916, ...	1.65	2.00	11.00	10.00	1.00
Sharpless & Carpenter's Grain Mixture, ...	1.65	2.00	11.00	10.00	......
Sharpless & Carpenter's Practical Guano, ...	2.47	3.00	11.00	10.00	......
Sharpless & Carpenter's Gold Seal Potato Manure	3.29	4.00	11.00	10.00	......
Sharpless & Carpenter's Griscom's King Crab Compound, ...	4.11	5.00	9.00	8.00	......
Sharpless & Carpenter's Royal Spring Mixture, 1916, ...	0.82	1.00	9.00	8.00	1.00
Sharpless & Carpenter's Farmer's Brand Phosphate, 1916, ...	0.82	1.00	11.00	10.00	1.00
Sharpless & Carpenter's Fish Guano, 1916, Revised	0.82	1.00	11.00	10.00	1.00
Sharpless & Carpenter's Potato, Corn and Truck Guano, 1916, ...	1.23	1.50	11.00	10.00	1.00
Sharpless & Carpenter's, No. 1 Brand Phosphate, 1916, ...	1.65	2.00	10.00	9.00	1.00
Sharpless & Carpenter's Complete Manure, 1916, Revised, ...	1.65	2.00	10.00	9.00	1.00
Sharpless & Carpenter's Complete Manure, 1916,	1.65	2.00	11.00	10.00	1.00
Sharpless & Carpenter's Fish Guano, 1916, ...	2.06	2.50	9.00	8.00	1.00
Sharpless & Carpenter's Vegetable and Potato Manure, 1916, ...	2.47	3.00	10.00	9.00	1.00
Sharpless & Carpenter's Soluble Tampico Guano, 1916, ...	3.29	4.00	10.00	9.00	1.00
Allen's Popular Phosphate, 1916, ...	0.82	1.00	9.00	8.00	1.00
Tygert-Allen's Star Potato Grower, 1916, ...	1.23	1.50	11.00	10.00	1.00
Tygert-Allen's Standard Brand Phosphate, 1916,	1.65	2.00	10.00	9.00	1.00
Tygert-Allen's Reliable Crop Grower, 1916, ...	1.65	2.00	11.00	10.00	1.00
Tygert-Allen's Star Brand Phosphate, 1916, ...	2.06	2.50	9.00	8.00	1.00
Allen's Sweet Potato Manure, 1916, ...	2.06	2.50	11.00	10.00	1.00
Allen's Potato and Truck Manure, 1916, ...	2.47	3.00	10.00	9.00	1.00
Allen's 10% Guano, 1916, ...	8.23	10.00	6.00	5.00	1.00
Wheeler's Peerless Acid Phosphate, ...	......	......	15.00	14.00	......
Wheeler's High Grade Acid Phosphate, ...	......	......	17.00	16.00	......
Wheeler's Royal Wheat Grower, 1916, ...	0.82	1.00	9.00	8.00	1.00
Wheeler's Corn Fertilizer, 1916, ...	1.65	2.00	11.00	10.00	1.00
Wheeler's Potato Manure, 1916, ...	2.06	2.50	11.00	10.00	1.00
Wheeler's Reliable Manure, 1916, ...	2.47	3.00	10.00	9.00	1.00
Wheeler's High Grade Special, 1916, ...	3.29	4.00	10.00	9.00	1.00
Williams & Clark's Sterling Mixture, ...	1.65	2.00	11.00	10.00	......
Williams & Clark's Mammoth Crop Producer, ..	2.47	3.00	11.00	10.00	......
Williams & Clark's Special Potato and Root Fertilizer, ...	3.29	4.00	11.00	10.00	......

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
The American Ag'l Chemical Co., N. Y. City—Cont.					
Williams & Clark's Special Prolific Crop Producer	0.82	1.00	9.00	8.00	1.00
Williams & Clark's Matchless Fertilizer, 1916, ..	1.65	2.00	10.00	9.00	1.00
Williams & Clark's Meadow Queen Fertilizer, 1916	2.47	3.00	10.00	9.00	1.00
Williams & Clark's Potato Special, ...	3.29	4.00	9.00	8.00	3.00
Williams & Clark's Americus High Grade Special for Potatoes and Root Crops, 1916, ...	3.29	4.00	10.00	9.00	1.00
Williams & Clark's Utility Brand, ...	3.29	4.00	11.00	10.00	3.00
American Fertilizing Co., Baltimore, Md.					
High Grade Acid Phosphate, ...	......	......	15.00	14.00	......
American High Grade Acid Phosphate, ...	......	......	17.00	16.00	......
American Alkaline Mixture, ...	......	......	9.00	8.00	3.00
American Phosphate and Potash, ...	......	......	11.00	10.00	1.00
American Dissolved Phosphate and Potash, ...	......	......	11.00	10.00	2.00
American Special Fish Guano, ...	0.82	1.00	11.00	10.00	......
American Champion Ammoniated Phosphate, ...	1.65	2.00	11.00	10.00	......
American Fish Special, ...	1.65	2.00	12.00	11.00	......
American Eagle Ammoniated Compound, ...	2.47	3.00	11.00	10.00	......
American Eagle Potato and Truck Grower, ...	3.29	4.00	9.00	8.00	......
American Truck and Vegetable Fertilizer, ...	3.29	4.00	11.00	10.00	......
American Truck Ammoniated Superphosphate, ..	4.12	5.00	9.00	8.00	......
American Potato Superphosphate, ...	4.12	5.00	11.00	10.00	......
American Reliable Guano, ...	0.82	1.00	9.00	8.00	1.00
Ammoniated Crop Compound, ...	0.82	1.00	9.00	8.00	2.00
American Grain and Grass Grower, ...	0.82	1.00	10.00	9.00	3.00
American Eagle Crop Grower, ...	1.65	2.00	9.00	8.00	2.00
American Fish and Potash Compound, ...	1.65	2.00	9.00	8.00	3.00
American Fish and Potash Compound, Revised, 1918, ...	1.65	2.00	9.50	8.50	1.00
American Eagle Guano, Revised, ...	2.47	3.00	9.00	8.00	2.00
American Potato Guano with 1% Potash, ...	3.29	4.00	9.00	8.00	1.00
American Potato and Truck Guano, ...	3.29	4.00	9.00	8.00	2.00
American Eagle Truck and Vegetable Manure, ..	3.29	4.00	9.00	8.00	3.00
American Potato and Vegetable Manure with 1% Potash, ...	3.29	4.00	11.00	10.00	1.00
American Potato and Vegetable Compound, ...	3.29	4.00	11.00	10.00	2.00
American Eagle Truck Fertilizer with 1% Potash,	4.12	5.00	9.00	8.00	1.00
American Eagle Truckers Special, ...	4.12	5.00	9.00	8.00	2.00
American Potato and Truck Compound, ...	4.12	5.00	9.00	8.00	3.00
Armour Fertilizer Works, Baltimore, Md.					
Acid Phosphate, ...	......	......	14.50	14.00	......
Star Phosphate, ...	......	......	14.50	14.00	......
Acid Phosphate, ...	......	......	16.50	16.00	......
Phosphate and Potash, No. 1, ...	......	......	10.50	10.00	2.00

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
Armour Fertilizer Works, Baltimore, Md.—Cont.					
Phosphate and Potash,	......	......	10.50	10.00	2.00
Bone Meal,	2.47	3.00	22.00	......	......
Animal Bone,	2.47	3.00	22.00	......	......
Raw Bone Meal,	3.70	4.50	21.50	......	......
Tuscarora's 1-10-0 Fertilizer,	0.82	1.00	10.50	10.00	......
Armour's 1-10-0 Fertilizer,	0.82	1.00	10.50	10.00	......
Armour's 1½-9-0 Fertilizer,	1.23	1.50	9.50	9.00	......
Tuscarora's 1½-9-0 Fertilizer,	1.23	1.50	10.50	10.00	......
Tuscarora's 2-10-0 Fertilizer,	1.65	2.00	10.50	10.00	......
Armour's 2-10-0 Fertilizer,	1.65	2.00	10.50	10.00	......
Armour's 3-10-0 Fertilizer,	2.47	3.00	10.50	10.00	......
Tuscarora's 3-10-0 Fertilizer,	2.47	3.00	10.50	10.00	......
Tuscarora's 4-10-0 Fertilizer,	3.29	4.00	10.50	10.00	......
Armour's 4-10-0 Fertilizer,	3.29	4.00	10.50	10.00	......
Armour's 5-10-0 Fertilizer,	4.11	5.00	10.50	10.00	......
Tuscarora's 5-10-0 Fertilizer,	4.11	5.00	10.50	10.00	......
Wheat Corn and Oats Special,	0.82	1.00	7.50	7.00	1.00
Ammoniated Phosphate,	0.82	1.00	7.50	7.00	1.00
Crop Grower,	0.82	1.00	8.50	8.00	2.00
Royal Ammoniated,	0.82	1.00	8.50	8.00	4.00
York State Special,	0.82	1.00	8.50	8.00	4.00
Grain Grower,	1.65	2.00	8.50	8.00	2.00
Standard,	1.65	2.00	8.50	8.00	2.00
Tuscarora's 2-8-5 Fertilizer,	1.65	2.00	8.50	8.00	5.00
Fruit and Root Crop Special,	1.65	2.00	8.50	8.00	5.00
Armour's 4-8-3 Fertilizer,	3.29	4.00	8.50	8.00	3.00
Tuscarora's 4-8-3 Fertilizer,	3.29	4.00	8.50	8.00	3.00
Tuscarora's 4-8-4 Fertilizer,	3.29	4.00	8.50	8.00	4.00
Armour's 4-8-4 Fertilizer,	3.29	4.00	8.50	8.00	4.00
M. B. Atkinson, Bogota, N. J.					
Atkinson's Prepared Humus,	1.25	1.50	1.00	......	......
James H. Baird & Son, Marlboro, N. J.					
4½-10½-0,	3.70	4.50	12.50	10.50	......
Baltimore Pulverizing Co., Baltimore, Md.					
Special Spring and Fall Mixture,	......	......	9.00	8.00	1.00
Corn and Grain,	......	......	13.00	12.00	1.00
Ammoniated Fish Guano, No. 1,	2.46	3.00	9.00	8.00	......
Farmers' Favorite Fertilizer,	0.82	1.00	8.00	7.50	1.00
Penniman's Special Guano,	0.82	1.00	9.00	8.00	1.00
Special Potato Mixture,	1.64	2.00	8.00	7.00	1.00
Ammoniated Fish Guano, No. 2,	2.46	3.00	9.00	8.00	2.00
Special Strawberry Compound,	3.28	4.00	8.00	7.00	1.00

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
The Barrett Co., New York City.					
Arcadian Sulphate of Ammonia,	20.75	25.25	......	......	......
Baugh & Sons Co., Philadelphia, Pa.					
Dried Ground Blood,	9.88	12.00	......	......	......
Nitrate of Soda,	15.23	18.50	......	......	......
Sulphate of Ammonia,	20.57	25.00	......	......	......
Baugh's Pure Steamed Bone,	1.65	2.00	25.00	......	......
Baugh's Raw Bone Meal,	3.30	4.00	18.30	......	......
Baugh's High Grade Tankage,	4.94	6.00	3.00	......	......
Baugh's High Grade Tankage,	5.76	7.00	3.50	......	......
Ground Fish,	5.80	7.00	4.80	......	......
Baugh's High Grade Tankage,	6.58	8.00	4.00	......	......
Ground Fish,	7.42	9.00	6.00	......	......
Ground Fish,	8.23	10.00	6.87	......	......
Finely Ground Pure Phosphate Rock Unacidulated	......	......	30.50	......	......
Baugh's 14% Acid Phosphate,	......	......	14.00	14.00	......
Baugh's 16% Acid Phosphate,	......	......	16.00	16.00	......
Baugh's Peninsula Grain Producer, 1919,	0.82	1.00	9.00	9.00	......
Baugh's Corn and Oats Fertilizer,	1.65	2.00	10.00	10.00	......
Baugh's The Old Stand-By; Dissolved Animal Base	1.65	2.00	12.00	12.00	......
Baugh's Truckers' Favorite,	2.47	3.00	10.00	10.00	......
Baugh's High-Grade Ammoniated Animal Base,.	3.30	4.00	10.00	10.00	......
Baugh's Superb Potato Phosphate,	4.12	5.00	10.00	10.00	......
Baugh's General Crop Grower for All Crops, ...	0.82	1.00	8.00	8.00	1.00
Baugh's Special Vegetable Fertilizer,	0.82	1.00	9.00	9.00	3.00
Baugh's Complete Animal Base Fertilizer, 1919,	1.65	2.00	10.00	10.00	1.00
Baugh's Special Potato Manure, 1919,	1.65	2.00	10.00	10.00	1.00
Baugh's Durable Plant Food,	1.65	2.00	8.00	8.00	2.00
Baugh's High-Grade Potato Grower, "Big Potato" Brand,	3.30	4.00	8.00	8.00	1.00
Baugh's White Potato Special,	3.30	4.00	8.00	8.00	3.00
Baugh's Peruvian Guano Substitute for Potatoes and All Vegetables, 1919,	4.12	5.00	8.00	8.00	1.00
Various Special Mixtures of Registered Ingredients, in accordance with ruling of State Chemist.					
Berger Bros., Easton, Pa.					
Peerless Phosphate, 1916,	0.82	1.00	9.00	8.00	......
Lehigh Superphosphate, 1916,	1.65	2.00	11.00	10.00	......
The Berg Co., Philadelphia, Pa.					
Berg's Raw Bone Fine,	3.00	3.64	22.00	......	......
Berg's Special Wheat Grower,	1.65	2.00	11.00	8.00	......
Berg's Special Crop Grower,	1.65	2.00	14.00	10.00	......
Berg's Special Bone Manure without Potash, ...	2.00	2.43	11.00	7.00	......

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
The Berg Co., Philadelphia, Pa.—Continued.					
Berg's Special Truck Grower,	2.47	3.00	14.00	10.00	......
Berg's Bone and Meat,	3.30	4.00	17.00	14.00	......
Berg's Uneed Bone Manure,	1.65	2.00	11.00	8.00	1.00
Berg's Bone and Potash Guano,	1.65	2.00	14.00	10.00	2.00
Berg's Vigor Volo Bone Manure,	2.00	2.43	11.00	7.00	1.00
Berg's Standard Bone Manure, 1919,	2.47	3.00	14.00	10.00	3.00
Bon Arbor Chemical Co., Paterson, N. J.					
Wood Ashes,	......	......	1.00	......	1.00
Bon Arbor, No. 1 Soluble Plant Life,	15.00	18.21	5.00	5.00	5.00
Bowker Fertilizer Co., New York City.					
Bowker's Soluble Phosphate,	......	......	15.00	14.00	......
Bowker's 16% Acid Phosphate,	......	......	17.00	16.00	......
Bowker's Fresh Ground Bone,	2.47	3.00	22.88	......	......
Bowker's Superphosphate with Ammonia 1%,	0.82	1.00	11.00	10.00	......
Bowker's Superphosphate with Ammonia 2%,	1.65	2.00	11.00	10.00	......
Bowker's Superphosphate with Ammonia 3%,	2.47	3.00	11.00	10.00	......
Bowker's Superphosphate with Ammonia 4%,	3.29	4.00	11.00	10.00	......
Bowker's Superphosphate with Ammonia 5%,	4.11	5.00	9.00	8.00	......
Bowker's High Nitrogen Mixture without Potash,	8.23	10.00	6.00	5.00	......
Bowker's Staple Phosphate, 1916,	0.82	1.00	9.00	8.00	1.00
Bowker's Wheat and Corn Fertilizer,	0.82	1.00	9.00	8.00	2.00
Bowker's Sure Crop Phosphate, 1916,	0.82	1.00	11.00	10.00	1.00
Bowker's Standard Phosphate,	1.65	2.00	9.00	8.00	2.00
Bowker's Farm and Garden Phosphate, 1916, Revised,	1.65	2.00	10.00	9.00	1.00
Bowker's Farm and Garden Phosphate, 1916,	1.65	2.00	11.00	10.00	1.00
Bowker's Sweet Potato and Truck Manure, 1916,	1.65	2.00	11.00	10.00	1.00
Bowker's All Round Fertilizer, 1916,	2.06	2.50	11.00	10.00	1.00
Bowker's Lawn and Garden Dressing, 1918,	2.47	3.00	9.00	8.00	1.00
Bowker's Hill and Drill Phosphate, 1916,	2.47	3.00	10.00	9.00	1.00
Bowker's Superior Fish Guano for Broadcasting,	3.29	4.00	6.00	5.00	1.00
Bowker's Potato Special,	3.29	4.00	9.00	8.00	3.00
Stockbridge General Crop Manure, 1916,	3.29	4.00	10.00	9.00	1.00
Bowker's Complete,	3.29	4.00	11.00	10.00	3.00
Louis Burk, Philadelphia, Pa.					
Tankage,	3.60	4.38	19.90	12.71	......
Chamberlin & Barclay, Cranbury, N. J.					
Chamberlin & Barclay's, 1919, Special,	3.29	4.00	8.00	8.00	3.00
Chicago Feed & Fertilizer Co., Chicago, Ill.					
Magic Brand Pulverized Sheep Manure,	1.85	2.25	1.50	1.43	1.25
The Coe-Mortimer Co., New York City.					
E. Frank Coe's Basic Fruit and Legume Phosphate (Basic Lime Phosphate) (Key-Plow Brand),	......	......	14.00	13.00	......
E. Frank Coe's High Grade Soluble Phosphate,	......	......	15.00	14.00	......

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
The Coe-Mortimer Co., New York City—Continued.					
E. Frank Coe's 16% Superphosphate,	......	......	17.00	16.00	......
Fine Ground Bone,	2.47	3.00	22.88	......	......
E. Frank Coe's XXV Ammoniated Phosphate, 1916,	0.82	1.00	11.00	10.00	......
E. Frank Coe's Original Ammoniated Dissolved Phosphate, 1916,	1.65	2.00	11.00	10.00	......
E. Frank Coe's High Grade Ammoniated Superphosphate, 1916,	2.47	3.00	11.00	10.00	......
E. Frank Coe's Prolific Crop Producer, 1916,	3.29	4.00	11.00	10.00	......
E. Frank Coe's Gardners' and Truckers' Special, 1916,	4.11	5.00	9.00	8.00	......
E. Frank Coe's Top Dressing Manure, 1916,	6.58	8.00	9.00	8.00	......
E. Frank Coe's New Englander Special, 1916,	0.82	1.00	9.00	8.00	1.00
E. Frank Coe's General Crop Manure, Revised,	0.82	1.00	9.00	8.00	2.00
E. Frank Coe's Columbian Corn and Potato Fertilizer, 1916,	1.23	1.50	11.00	10.00	1.00
E. Frank Coe's Empire State Brand, Revised,	1.65	2.00	9.00	8.00	2.00
E. Frank Coe's Universal Fertilizer, 1916,	1.65	2.00	10.00	9.00	1.00
E. Frank Coe's Gold Brand Excelsior Guano, 1916	2.47	3.00	10.00	9.00	1.00
E. Frank Coe's Standard Potato Fertilizer, 1916,	3.29	4.00	10.00	9.00	1.00
E. Frank Coe's Monmouth County Special Potato Fertilizer, Revised,	3.29	4.00	9.00	8.00	3.00
E. Frank Coe's Red Brand Excelsior Guano, 1916	4.11	5.00	9.00	8.00	1.00
Country Club (Reg. U. S. Pat. Office), Golf and Lawn Fertilizer, 1916, Brand A. for Putting Greens,	5.76	7.00	4.00	3.00	1.00
J. S. Collins & Son, Inc., Moorestown, N. J.					
Armour's Bone Meal Fertilizer,	2.47	3.00	......	......	......
Dried and Ground Fish,	10.00	12.00	......	......	......
Nitrate Soda,	14.81	18.00	......	......	......
16% Acid Phosphate,	......	......	17.00	16.00	......
Special 2-12 Fertilizer,	1.61	2.00	13.00	12.00	......
Special 3-10 Fertilizer,	2.46	3.00	11.00	10.00	......
Special 4-10 Fertilizer,	3.29	4.00	11.00	10.00	......
Armour's Sheep Manure,	1.66	2.00	1.00	1.00	3.25
The Consumers Chemcial Corp., New York City.					
Consumer's Dried Fish,	8.23	10.00	......	......	......
Consumer's Tankage,	8.23	10.00	......	......	......
Consumer's Nitrate of Soda,	14.81	18.00	......	......	......
Consumer's Pure-Sure Acid Phosphate,	......	......	15.00	14.00	......
Consumer's High Grade Acid Phosphate,	......	......	17.00	16.00	......
Consumer's Bone Meal,	2.47	3.00	22.00	......	......
Consumer's Pure-Sure Phosphate and Potash,	......	......	10.00	9.00	2.00
Consumer's Pure-Sure Potash Mixture,	......	......	11.00	10.00	1.00

Brands Registered for the Fiscal Year Ending October 31, 1919

	Analysis Guaranteed Minimum				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
The Consumers Chemical Corp., N. Y. City—Cont.					
Consumer's All Crop Compound (without Potash)	0.82	1.00	10.00	9.00	......
Consumer's Pure-Sure Ammoniated Bone Phosphate,	1.65	2.00	11.00	10.00	......
Consumer's Pure-Sure Corn and Grain Bone Phosphate,	1.65	2.00	13.00	12.00	......
Consumer's Pure-Sure Corn and Vegetable (without Potash),	2.47	3.00	11.00	10.00	......
Consumer's Pure-Sure Potato and Vegetable (without Potash),	3.29	4.00	11.00	10.00	......
Consumer's Pure-Sure Potato Manure (without Potash),	4.11	5.00	11.00	10.00	......
Consumer's Pure-Sure Truckers' Mixture (without Potash),	4.94	6.00	9.00	8.00	......
Consumer's Pure-Sure Plant Food,	0.82	1.00	9.00	8.00	1.00
Consumer's All Crop Compound,	0.82	1.00	10.00	9.00	3.00
Consumer's XXXX Fish and Potash Mixture,	1.65	2.00	9.00	8.00	1.00
Consumer's Complete Compound,	1.65	2.00	9.00	8.00	2.00
Consumer's Pure-Sure Fertilizer for General Use,	1.65	2.00	9.00	8.00	3.00
Consumer's Pure-Sure Corn and Vegetable (with 1% Potash),	2.47	3.00	9.00	8.00	1.00
Consumer's Pure-Sure Potato and Vegetable (with 1% Potash),	3.29	4.00	9.00	8.00	1.00
Consumer's Pure-Sure Potato and Vegetable (with 3% Potash),	3.29	4.00	9.00	8.00	3.00
Consumer's Pure-Sure Potato Manure (with 1% Potash),	4.11	5.00	9.00	8.00	1.00
E. Dougherty, Philadelphia, Pa.					
Nitrate of Soda,	15.00	18.23	......	......	......
Sulphate of Ammonia,	20.15	24.50	......	......	......
Acid Phosphate,	......	......	14.75	14.00	......
Acid Phosphate,	......	......	......	16.00	......
Domestic Potash Material,	......	......	......	......	23.00
Low Grade Muriate of Potash,	......	......	......	......	40.00
Sulphate of Potash,	......	......	......	......	47.00
Muriate of Potash,	......	......	......	......	50.00
Pulverized Sheep Manure,	1.64	2.00	1.00	......	......
Ground Steamed Bone,	2.46	3.00	22.88	......	......
Tankage,	4.11	5.00	6.86	......	......
Ground Tankage,	4.94	6.00	9.16	......	......
Fish Guano Compound,	5.75	7.00	4.57	......	......
James G. Downward Co., Coatesville, Pa.					
Ammoniated Phosphate,	0.82	1.00	11.00	10.00	......
Potato, Corn and Grain Phosphate,	1.65	2.00	11.00	10.00	......
Pioneer Potato Phosphate,	2.46	3.00	11.00	10.00	......

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
The Fertile Chemical Co., Cleveland, Ohio.					
Lime-Fertile,	......	......	3.00	......	......
Nitro-Fertile,	2.00	2.40	3.00	3.00	3.00
J. Fischer & Co., Keyport, N. J.					
Nitrate of Soda Sweepings (Sifted),	10.00	12.14	......	......	......
Fogg & Hires Co., Salem, N. J.					
Wonder Brand,	3.29	4.00	8.00	8.00	3.00
Alexander Forbes & Co., Newark, N. J.					
Forbes Complete Garden Fertilizer War Brand,	1.65	2.00	10.00	8.00	......
Forbes Perfection Lawn Dressing War Brand,	2.47	3.00	10.00	8.00	1.00
D. Fullerton & Co., Paterson, N. J.					
Tankage,	7.03	8.53	6.15	......	......
Godfrey Co-operative Fertilizer and Chemical Co., Newark, N. J.					
Godfrey's 14% Acid Phosphate,	......	......	14.50	14.00	......
Godfrey's 16% Acid Phosphate,	......	......	16.50	16.00	......
Godfrey's Phosphate and Potash,	......	......	10.50	10.00	2.00
Godfrey's Pure Bone Meal,	2.47	3.00	23.00	......	......
Godfrey's Raw Bone Meal,	3.70	4.50	21.50	......	......
Godfrey's Special Florists' Tankage,	4.94	6.00	12.00	......	......
Godfrey's High Grade Florists' Tankage,	7.40	9.00	6.00	......	......
Godfrey's Special Mixture,	0.82	1.00	10.50	10.00	......
Godfrey's Grain Grower,	1.23	1.50	9.50	9.00	......
Godfrey's Corn Mixture,	1.65	2.00	10.50	10.00	......
Godfrey's Vegetable Mixture,	2.47	3.00	10.50	10.00	......
Godfrey's Early Potato Mixture,	3.29	4.00	10.50	10.00	......
Godfrey's Potato and Truck Mixture,	4.11	5.00	10.50	10.00	......
Godfrey's Special,	0.82	1.00	7.50	7.00	1.00
Godfrey's Special Grain and Sure Crop Fertilizer, Revised,	0.82	1.00	8.50	8.00	2.00
Godfrey's Superior Grain Fertilizer,	0.82	1.00	8.50	8.00	4.00
Godfrey's Grain and Grass Fertilizer,	1.65	2.00	8.50	8.00	2.00
Godfrey's Corn and Truck Grower,	1.65	2.00	8.50	8.00	5.00
Godfrey's Corn Grower, Revised,	1.65	2.00	10.50	10.00	2.00
Godfrey's H. G. Market Garden Manure, Revised,	3.29	4.00	8.50	8.00	1.00
Godfrey's Potato and Truck Fertilizer,	3.29	4.00	8.50	8.00	3.00
Godfrey's Potato and Truck Grower,	3.29	4.00	8.50	8.00	4.00
Godfrey's Potato Manure, Revised,	3.29	4.00	9.50	9.00	2.00
G. G. Green, Jr., Woodbury, N. J.					
Pure Ground Bone,	2.47	3.00	22.90	......	......
Hafleigh & Co., Philadelphia, Pa.					
Pure Raw Bone Meal,	3.75	4.50	25.84	......	......

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
Peter Henderson & Co., New York City.					
Henderson's Raw Bone Meal,	2.47	3.00	20.00	......	......
Henderson's Special Blood and Bone Fertilizer,	3.29	4.00	17.00	......	......
Henderson's Worm Killing Grass Food,	2.36	2.87	......	......	1.00
Henderson's Lawn Enricher War Special,	2.47	3.00	4.50	3.50	1.00
Henderson's Garden Fertilizer War Special,	4.12	5.00	8.00	6.00	1.00
Henderson's Superior Fertilizer for House Plants,	4.50	5.46	10.00	5.50	2.00
Heritage & Brother, Mullica Hill, N. J.					
Pancoast's Sweet Potato Fertilizer,	1.65	2.00	11.00	10.00	......
Pancoast's Old Reliable Potato Grower,	3.29	4.00	9.00	8.00	......
Pancoast's Jersey Potato Guano,	4.12	5.00	11.00	10.00	......
Pancoast's Royal Fish and Potash Mixture,	1.65	2.00	9.00	8.00	3.00
Pancoast's Champion Potato & Vegetable Grower,	3.29	4.00	9.00	8.00	3.00
S. M. Hess & Brother, Inc., Philadelphia, Pa.					
Nitrate of Soda,	15.00	18.23	......	......	......
Acid Phosphate,	......	......	13.00	12.00	......
High Grade Acid Phosphate,	......	......	15.00	14.00	......
Special High Grade Acid Phosphate,	......	......	17.00	16.00	......
Fine Ground Bone,	2.47	3.00	22.88	......	......
High Grade Ground Bone,	3.29	4.00	20.59	......	......
Ammoniated Grain Grower,	0.82	1.00	9.00	8.00	......
Standard Superphosphate,	0.82	1.00	11.00	10.00	......
Superior Superphosphate,	1.65	2.00	11.00	10.00	......
Reliable Superphosphate,	2.47	3.00	11.00	10.00	......
High Grade Superphosphate,	3.29	4.00	11.00	10.00	......
Market Gardeners' Manure,	4.11	5.00	9.00	8.00	......
High Grade Potato Grower,	4.11	5.00	11.00	10.00	......
Top Dressing Manure,	8.23	10.00	6.00	5.00	......
Keystone Phosphate,	0.82	1.00	9.00	8.00	1.00
Special Corn Manure, 1916,	0.82	1.00	11.00	10.00	1.00
Wheat and Grass Manure, 1916,	0.82	1.00	11.00	10.00	1.00
Ammoniated Superphosphate, 1916,	1.65	2.00	10.00	9.00	1.00
Fish and Potash Manure, 1916,	1.65	2.00	10.00	9.00	1.00
Big Crop Fertilizer, 1916,	1.65	2.00	11.00	10.00	1.00
Potato Manure, 1916,	2.47	3.00	10.00	9.00	1.00
Farmers' Potato and Truck Grower, 1919,	3.29	4.00	9.00	8.00	3.00
Special Cabbage Manure, 1916,	3.29	4.00	10.00	9.00	1.00
Special Potato Manure, 1916,	3.70	4.50	9.00	8.00	1.00
Vegetable Compound, 1916,	4.11	5.00	9.00	8.00	1.00
Hill Brothers, Flemington, N. J.					
Hill Bros., No. 2 Revised Phosphate,	0.82	1.00	11.00	10.00	......
Hill Bros. Eureka Brand Phosphate,	0.82	1.00	11.00	10.00	1.00

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
Thomas Hill, Flemington, N. J.					
Thomas Hill's 2-10,	1.65	2.00	11.00	10.00	......
Thomas Hill's 2-12,	1.65	2.00	13.00	12.00	......
Thomas Hill's 3.10,	2.47	3.00	11.00	10.00	......
P. Hoffman & Bro., Raubsville, Pa.					
Hoffman's All Crops,	0.82	1.00	10.00	7.00	......
The Hubbard Fertilizer Co., Baltimore, Md.					
Hubbard's 14% Phosphate,	......	......	15.00	14.00	......
Hubbard's 16% Phosphate,	......	......	17.00	16.00	......
Hubbard s Oriental Guano,	0.82	1.00	11.00	10.00	......
Hubbard's Excelsior Mixture,	1.64	2.00	11.00	10.00	......
Hubbard's 4-10-0 Fertilizer,	3.28	4.00	11.00	10.00	......
Hubbard's Farmers' I. X. L.,	1.64	2.00	9.00	8.00	2.00
Hubbard's 4-8-3 Fertilizer,	3.28	4.00	9.00	8.00	3.00
Hubbard's 4-10-3 Fertilizer,	3.28	4.00	11.00	10.00	3.00
Hudson Carbon Co., Ballston, N. Y.					
Davidge's Special Phosphorus,	......	......	5.00	......	......
Davidge's Concentrated Manure,	1.00	1.25	1.00	......	......
Davidge's A 1 Manure,	1.00	1.25	1.00	......	......
Humus Natural Manure Co., Brooklyn, N. Y.					
Humus Natural Manure,	1.25	1.50	......	......	......
Hyper Humus Co., Newton, N. J.					
Hyper Humus,	1.33	1.61	......	......	......
International Agriculture Corp-Buffalo Fertilizer Works, Buffalo, N. Y.					
Buffalo Sixteen Percent,	......	......	17.00	16.00	......
Buffalo Farmers Choice,	0.80	1.00	11.00	10.00	......
Buffalo Ammoniated Phosphate,	1.20	1.50	13.00	12.00	......
Buffalo Ideal Wheat and Corn,	1.60	2.00	11.00	10.00	......
Buffalo Vegetable and Potato,	2.50	3.00	11.00	10.00	......
Buffalo Garden Truck,	3.30	4.00	11.00	10.00	......
Buffalo General Favorite,	0.80	1.00	9.00	8.00	1.00
Buffalo Potash Special,	0.80	1.00	9.00	8.00	3.00
Buffalo Triumph,	1.60	2.00	9.00	8.00	2.00
Buffalo Potato and Corn,	1.60	2.00	9.00	8.00	4.00
International Seed Co., Rochester, N. Y.					
International Crop Grower,	0.82	1.00	11.00	10.00	......
International General Phosphate,	1.65	2.00	11.00	10.00	......
International Grain Fertilizer,	0.82	1.00	11.00	10.00	1.00
International Special Manure,	1.65	2 00	11.00	10.00	1.00
John Joynt, Lucknow, Ontario, Canada.					
"The Joynt Brand" Canada Unleached Hardwood Ashes,	......	......	1.00	......	2.00

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
H. B. Kemp, Long Branch, N. J.					
Kemp's Garden City Phosphate,	......	......	14.00	14.00	......
Kemp's Pure Bone Meal,	2.47	3.00	23.00	......	......
Kemp's Raw Bone Meal,	3.70	4.50	21.50	......	......
Kemp's Grain and Grass Grower,	1.65	2.00	10.50	10.00	......
Kemp's Lawn Dressing,	2.47	3.00	10.50	10.00	......
Kemp's Corn and Truck Fertilizer,	2.47	3.00	10.50	10.00	......
Kemp's Ideal Potato Fertilizer,	3.29	4.00	8.50	8.00	......
Kemp's Potato and Vegetable Fertilizer,	3.29	4.00	10.50	10.00	......
Kemp's Ideal Garden Fertilizer,	4.11	5.00	8.50	8.00	......
Kemp's Early Truck Grower,	4.11	5.00	10.50	10.00	......
Kemp's Shredded Cattle Manure,	1.65	2.00	1.00	1.00	1.50
Kemp's Pulverized Cattle Manure,	1.65	2.00	1.00	1.00	1.50
Kemp's Pulverized Sheep Manure,	2.06	2.50	1.50	1.50	1.50
Kemp's Garden Fertilizer,	3.29	4.00	8.50	8.00	1.00
Kemp's Potato and Truck Fertilizer,	3.29	4.00	8.50	8.00	3.00
Kemp's High Grade Potato Manure,	3.29	4.00	8.50	8.00	4.00
Kemp's A 1 Potato Fertilizer,	3.29	4.00	9.50	9.00	2.00
Keystone Bone Fertilizer Co., Philadelphia, Pa.					
Keystone 14% Acid Phosphate,	......	......	15.00	14.00	......
Keystone 16% Acid Phosphate,	......	......	17.00	16.00	......
Keystone Pure Ground Bone,	2.05	2.50	20.00	......	......
1919 Keystone Fish and Tankage,	3.28	4.00	3.00	......	......
Keystone Economy Grain Compound,	0.82	1.00	10.00	9.00	......
Keystone Special Penna. Grain Mixture,	0.82	1.00	13.00	12.00	......
Keystone Ammoniated Superphosphate,	1.65	2.00	11.00	10.00	......
Keystone Standard Potato Manure Revised,	2.46	3.00	11.00	10.00	......
Keystone Special Potato and Tomato Mixture,	3.28	4.00	11.00	10.00	......
Keystone High Grade Truck Guano,	4.10	5.00	9.00	8.00	......
Keystone Special Truck and Corn Manure,	4.10	5.00	11.00	10.00	......
Keystone Grain and Grass Manure,	0.82	1.00	8.00	7.00	1.00
1919 Keystone Sweet Potato Manure,	1.65	2.00	9.00	8.00	2.00
Keystone Extra Potato Manure,	2.46	3.00	9.00	8.00	2.00
1919 Keystone Supreme Potato and Truck Manure	3.28	4.00	9.00	8.00	2.00
Keystone Gold Medal Special,	3.28	4.00	9.00	8.00	3.00
Kirke Chemical Co., Inc., Brooklyn, N. Y.					
Kirke Fertilizer,	5.00	6.10	8.25	7.50	3.00
Benjamin Lieber, Atlantic City, N. J.					
Flag Brand Tankage,	4.04	4.91	17.89	......	......
Sow Easy Fertilizer,	4.49	5.45	17.18	......	......
Listers Agricultural Chemical Works, Newark, N. J.					
Listers Buyer's Choice Acid Phosphate,	......	......	15.00	14.00	......
Listers High Grade Acid Phosphate,	......	......	17.00	16.00	......
Listers Dissolved Phosphate and Potash, 1916,	......	......	11.00	10.00	1.00

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
Listers Ag'l Chemical Works, Newark, N. J.—Cont.					
Listers Grain and Grass Fertilizer, 1916,	......	......	11.00	10.00	2.00
Listers Bone Meal, 1916,	2.47	3.00	23.00	......	......
Listers Celebrated Ground Bone and Tankage Acidulated,	2.67	3.25	12.00	......	......
Listers Plant Food, 1916, for Grain and Grass,	0.82	1.00	11.00	10.00	......
Listers Plant Food, 1916,	0.82	1.00	11.00	10.00	......
Listers Crescent Ammoniated Superphosphate, 1916	1.65	2.00	11.00	10.00	......
Listers Crescent Ammoniated Superphosphate, 1916, for Grain and Grass,	1.65	2.00	11.00	10.00	......
Listers Excelsior Guano, 1916,	2.47	3.00	11.00	10.00	......
Listers Superior Ammoniated Superphosphate, 1916	3.29	4.00	11.00	10.00	......
Listers Atlas Brand Fertilizer, 1916,	4.11	5.00	9.00	8.00	......
Listers Brakeley Special Mixture,	4.11	5.00	9.00	8.00	......
A. B. Special Fertilizer, Revised,	4.11	5.00	11.00	10.00	......
Listers Special Potato Fertilizer, 1916,	4.11	5.00	11.00	10.00	......
Listers Squirrel Brand Fertilizer, 1916,	0.82	1.00	9.00	8.00	1.00
Listers 1-8-2 Fertilizer,	0.82	1.00	9.00	8.00	2.00
Listers Valley Brand Fertilizer, 1916,	0.82	1.00	11.00	10.00	1.00
Listers Success Fertilizer, 1916,	1.23	1.50	11.00	10.00	1.00
Listers Harvest Queen Phosphate, 1916,	1.23	1.50	11.00	10.00	1.00
Listers U. S. Superphosphate, 1916,	1.23	1.50	11.00	10.00	1.00
Listers New York Special Fertilizer, 1916,	1.65	2.00	10.00	9.00	1.00
Listers Wheat and Rye Fertilizer, 1916,	1.65	2.00	11.00	10.00	1.00
Listers Corn and Potato Fertilizer, 1916,	2.06	2.50	9.00	8.00	1.00
Listers Ammoniated Dissolved Superphosphate, 1916,	2.06	2.50	9.00	8.00	1.00
Listers Lawn Fertilizer, 1916,	2.06	2.50	9.00	8.00	1.00
Listers Special Wheat Fertilizer, 1916,	2.06	2.50	9.00	8.00	1.00
Listers Potato and Corn, No. 2 Fertilizer, 1916,	2.06	2.50	11.00	10.00	1.00
Listers Standard Pure Superphosphate of Lime, 1916,	2.47	3.00	10.00	9.00	1.00
Listers 4-8-3 Fertilizer,	3.29	4.00	9.00	8.00	3.00
Listers Perfect Potato Manure, 1916,	3.29	4.00	10.00	9.00	1.00
Listers Vegetable Compound, 1916,	4.11	5.00	9.00	8.00	1.00
Locke & Black, Swedesboro, N. J.					
King Crab,	9.22	11.25	......	......	......
Bone Meal,	4.10	5.00	21.00	......	......
Bone Tankage,	4.51	5.50	21.00	......	......
6.25% Pure Animal Tankage,	5.12	6.25	7.00	......	......
6.75% High Grade Animal Tankage,	5.51	6.75	13.00	......	......
7.50% High Grade Animal Tankage,	6.15	7.50	10.00	......	......
No. 3 Sweet Potato Fertilizer,	1.64	2.00	11.00	10.00	......
No. 6 All Around Fertilizer,	2.05	2.50	8.00	7.00	......

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
Locke & Black, Swedesboro, N. J.—Continued.					
No. 1 High Grade Potato, Onion and Early Truck	3.70	4.50	9.00	8.00	......
No. 5 Special Early Tomato & Asparagus Grower,	4.10	5.00	9.00	8.00	......
No. 7 Sweet Potato Fertilizer Swedesboro Choice,	0.82	1.00	9.00	8.00	5.00
No. 4 Special Sweet Potato Fertilizer, ...	1.64	2.00	9.00	8.00	3.00
No. 2 White Potato and General Crop Grower, ..	2.46	3.00	9.00	8.00	3.00
No. 1½ Special White Potato, ...	3.28	4.00	9.00	8.00	3.00
Frederick Ludlam Co., New York City.					
Sickle Fertilizer No. 1, 1916, ...	0.82	1.00	11.00	10.00	......
Sickle Fertilizer No. 2, 1916, ...	1.65	2.00	11.00	10.00	......
Sickle Fertilizer No. 3, 1916, ...	2.47	3.00	11.00	10.00	......
Sickle Fertilizer No. 4, 1916, ...	3.29	4.00	11.00	10.00	......
Sickle Fertilizer No. 5, 1916, ...	4.11	5.00	9.00	8.00	......
Palmetto Fertilizer, 1916, ...	0.82	1.00	9.00	8.00	1.00
Cereal Fertilizer, 1916, ...	0.82	1.00	11.00	10.00	1.00
A. B. F. Fertilizer, 1916, Revised, ...	1.65	2.00	10.00	9.00	1.00
General Fertilizer, ...	2.47	3.00	10.00	9.00	1.00
Cecrops Fertilizer, 1916, ...	3.29	4.00	10.00	9.00	1.00
Cecrops Complete, ...	3.29	4.00	11.00	10.00	3.00
The Mapes Formula & Peruvian Guano Co., New York City.					
Mapes General Crop (1916 Brand), ...	1.65	2.00	10.00	8.00	......
Mapes Five Per Cent. Ammonia Special, ...	4.12	5.00	10.00	8.00	......
Mapes C. S. Special (without Potash), ...	4.12	5.00	4.00	4.00	......
Mapes Corn Manure (1916 Brand), ...	2.47	3.00	10.00	8.00	1.00
Mapes Potato Manure (1916 Brand), ...	3.71	4.50	8.00	8.00	1.00
Mapes Tobacco Starter, Improved, ...	4.12	5.00	8.00	6.00	1.00
Wm. Henry Maule, Inc., Philadelphia, Pa.					
Panmure Plant Food, 1919, ...	3.29	4.00	10.00	10.00	1.00
Mitchell Fertilizer Co., Tremley, N. J.					
Mitchell's 14% Acid Phosphate, ...	......	......	15.00	14.00	......
Mitchell's Special Lawn Dressing Fertilizer, Revised, ...	2.47	3.00	11.00	10.00	......
Mitchell's Special Lettuce Fertilizer, 1916, Revised	2.47	3.00	11.00	10.00	......
Mitchell's Special Celery Fertilizer, 1916, Revised	2.47	3.00	11.00	10.00	......
Mitchell's Special Vegetable Fertilizer, 1916, Revised, ...	2.47	3.00	11.00	10.00	......
Mitchell's Special Cabbage Fertilizer, 1916, Revised, ...	2.47	3.00	11.00	10.00	......
Mitchell's Special Corn Fertilizer, 1916, Revised,	2.47	3.00	11.00	10.00	......
Mitchell's Special Tomato Fertilizer, 1916, Revised	2.47	3.00	11.00	10.00	......
Mitchell's Special Asparagus Fertilizer, 1916, Revised, ...	2.47	3.00	11.00	10.00	......
Mitchell's Special Lawn Dressing Fertilizer, 1916,	2.47	3.00	10.00	9.00	1.00

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
Mitchell Fertilizer Co., Tremley, N. J.—Continued.					
Mitchell's Potato Fertilizer, 1916, Revised, ...	2.47	3.00	10.00	9.00	1.00
Monmouth County Farmers' Exchange, Freehold, N. J.					
Nitrate Soda, ...	14.80	18.00	......	......	......
Sulphate Ammonia, ...	20.50	25.00	......	......	......
Acid Phosphate, ...	......	......	16.00	16.00	......
Potash (Jesse Lake), ...	......	......	......	......	27.00
Ground Bone, ...	1.64	2.00	22.00	......	......
Ground Tankage, ...	5.35	6.50	9.00	......	......
Triangle Brand 2-11-0, ...	1.64	2.00	12.00	11.00	......
Triangle Brand 4-10-0, ...	3.29	4.00	11.00	10.00	......
Triangle Brand 4-8-3, ...	3.29	4.00	9.00	8.00	3.00
Joseph R. Moore, Swedesboro, N. J.					
J. R. Moore's King Crab, ...	9.87	12.00	......	......	......
J. R. Moore's 5½% Tankage, ...	4.53	5.50	15.00	......	......
J. R. Moore's 7% Tankage, ...	5.76	7.00	5.00	......	......
J. R. Moore's 8% Tankage, ...	6.50	8.00	7.00	......	......
Moore's 2-12-0 Sweet Potato Manure, ...	1.65	2.00	12.00	12.00	......
Moore's 4.10.0 Potato Manure, ...	3.29	4.00	10.00	10.00	......
Moore's Asparagus and Truck Manure 5-10-0, ..	4.12	5.00	10.00	10.00	......
Moore's 1-9-3 Sweet Potato Manure, ...	0.82	1.00	9.00	9.00	3.00
J. R. Moore's High Grade Potash Sweet Potato Manure, ...	0.86	1.00	8.00	8.00	5.00
Moore's 2-8-2 Sweet Potato Manure, ...	1.65	2.00	8.00	8.00	2.00
J. R. Moore's Early Truck and Potato Manure, ..	3.29	4.00	8.00	8.00	2.00
Moore's Superior Potato and Truck Manure, ...	3.29	4.00	8.00	8.00	3.00
J. R. Moore's Baxter Special Tomato Manure, ..	3.71	5.50	7.00	7.00	1.00
Moore's Baxter Improved Tomato Manure, ...	4.12	5.00	8.00	8.00	1.00
Nassau Fertilizer Co., New York City.					
Soluble Phosphate, ...	......	......	15.00	14.00	......
High Grade Superphosphate, ...	......	......	17.00	16.00	......
Buckwheat Special, ...	0.82	1.00	9.00	8.00	......
Old Hickory, 1916, ...	0.82	1.00	11.00	10.00	......
Common Sense Fertilizer, 1916, ...	1.65	2.00	11.00	10.00	......
Ammoniated Potato Compound, ...	2.47	3.00	11.00	10.00	......
Ammoniated Truck Producer, ...	3.29	4.00	11.00	10.00	......
Wheat and Grass Grower, 1916, ...	0.82	1.00	9.00	8.00	1.00
General Crop Fertilizer, ...	0.82	1.00	9.00	8.00	2.00
Special Mixture, 1916, ...	0.82	1.00	11.00	10.00	1.00
General Favorite Fish Mixture, ...	1.23	1.50	11.00	10.00	1.00
Plow Brand, 1916, ...	1.65	2.00	10.00	9.00	1.00
Big Yield, 1916, ...	1.65	2.00	11.00	10.00	1.00
Nassau Special, 1916, ...	2.47	3.00	10.00	9.00	1.00

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
Nassau Fertilizer Co., New York City—Continued.					
Gladiator Truck and Potato, Revised,	3.29	4.00	11.00	10.00	3.00
National Plant Food Co., Eau Claire, Wis.					
Red Snapper,	5.00	6.00	12.00	4.00	1.25
Natural Guano Co., Aurora, Ill.					
"Sheep's Head" Pulverized Sheep Manure,	2.25	2.73	1.25	1.00	1.50
Albert Nelson, Allentown, N. J.					
Nitrate of Soda,	14.82	18.00	......	......	......
Nelson's 14% Acid Phosphate,	......	......	15.00	14.00	......
Nelson's 16% Acid Phosphate,	......	......	17.00	16.00	......
Nelson's Special R. & W. Guano,	0.82	1.00	10.00	9.00	......
Nelson's Special G. & G. Guano,	1.65	2.00	11.00	10.00	......
Nelson's Special Corn Guano,	1.65	2.00	11.00	10.00	......
Nelson's Special Potato Grower,	3.29	4.00	9.00	8.00	......
Nelson's Superior Potato Grower,	4.12	5.00	9.00	8.00	......
Nelson's Special Fish and Potash,	1.65	2.00	10.00	8.50	1.00
Nelson's Special Potato Fertilizer,	3.29	4.00	9.00	8.00	2.00
Nelson's High Grade Potato Phosphate,	3.29	4.00	9.00	8.00	3.00
Nelson's Superior Potato Guano,	4.12	5.00	9.00	8.00	2.00
N. J. Fertilizer and Chemical Co., New York City.					
Ground Dried Blood,	13.16	16.00	......	......	......
Nitrate of Soda,	14.80	18.00	......	......	......
Sulphate of Ammonia,	20.56	25.00	......	......	......
Acid Phosphate 14% APA,	......	......	15.00	14.00	......
Acid Phosphate 16% APA,	......	......	17.00	16.00	......
Precipated Bone,	......	......	30.00	26.00	......
Ground Steamed Bone, 1 and 60,	0.82	1.00	27.46	......	......
Ground Steamed Bone, 2 and 60,	1.65	2.00	27.46	......	......
Ground Steamed Bone, 3 and 50,	2.46	3.00	22.89	......	......
Ground Tankage 7% and 15% BPL,	5.75	7.00	6.87	......	......
Ground Tankage 9% and 20% BPL,	7.40	9.00	9.15	......	......
Tobacco Dust,	1.65	2.00	......	......	2.00
Croxton Prepared Poultry Manure,	3.35	4.05	2.00	......	1.00
Croxton War Special,	3.30	4.00	8.00	8.00	1.00
Croxton Special Garden Fertilizer,	3.30	4.00	9.00	8.00	2.00
Croxton Complete Truck Guano,	3.35	4.05	9.00	8.00	5.00
Croxton Special Lawn Fertilizer,	5.00	6.00	9.00	8.00	2.00
New York Stable Manure Co., Jersey City, N. J.					
Dried Ground Manure, Compost-Diamond Brand,	2.06	2.50	1.79	1.50	1.00
Patapsco Guano Co., New York City.					
Patapsco Pure Dissolved S. C. Phosphate,	......	......	15.00	14.00	......
Patapsco High Grade Acid Phosphate,	......	......	17.00	16.00	......
Patapsco Ammoniated Compound,	0.82	1.00	11.00	10.00	......
Patapsco Golden Crop Fertilizer, 1916,	1.65	2.00	11.00	10.00	......

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
Patapsco Guano Co., New York City—					
Patapsco Truckers' Delight,	2.47	3.00	11.00	10.00	......
Patapsco Early Market Garden,	3.29	4.00	11.00	10.00	......
Patapsco Diamond Truck Manure, 1919,	4.11	5.00	9.00	8.00	......
Patapsco Hay Maker, Revised,	5.76	7.00	7.00	6.00	......
Coon Brand Guano, 1916, Revised,	0.82	1.00	10.00	9.00	1.00
Patapsco Fish Guano, 1916, Revised,	0.82	1.00	11.00	10.00	1.00
Grange Mixture, 1916,	1.65	2.00	10.00	9.00	1.00
Patapsco Special Prolific Potato Phosphate,	3.29	4.00	11.00	10.00	3.00
Philadelphia Guano Works, Philadelphia, Pa.					
Pure Ground Bone,	2.46	3.00	23.00	......	......
1919 Wheat and Grass Grower,	0.82	1.00	10.00	9.00	......
Grain Superphosphate,	0.82	1.00	13.00	12.00	......
1919 Corn and Vegetable Manure,	1.64	2.00	11.00	10.00	......
Acidulated Animal Compound,	1.64	2.00	15.00	10.00	......
1919 B Brand for Potatoes and Truck,	2.46	3.00	11.00	10.00	......
1919 A Brand for Potatoes and Truck,	3.30	4.00	11.00	10.00	......
1919 Truckers' Pride,	4.12	5.00	9.00	8.00	......
1919 Standard Truck Guano,	4.12	5.00	11.00	10.00	......
1919 Sweet Potato Manure,	1.64	2.00	9.00	8.00	2.00
1919 High Grade Potato Manure,	3.30	4.00	9.00	8.00	1.00
1919 Extra Potato Manure,	3.30	4.00	9.00	8.00	2.00
New Jersey Potato Special,	3.30	4.00	9.00	8.00	3.00
1919 Truck Guano,	4.12	5.00	7.00	6.00	1.00
Special Mixtures, in accordance with ruling of State Chemist.					
The Pulverized Manure Co., Chicago, Ill.					
Wizard Brand Manure,	1.80	2.10	1.00	1.00	1.00
Rasin-Monumental Co., Baltimore, Md.					
Rasin's Acid Phosphate,	......	......	15.00	14.00	......
Rasin's 16% Acid Phosphate,	......	......	17.00	16.00	......
Rasin's Special Alkaline Mixture,	......	......	9.00	8.00	3.00
Rasin's Phosphate and Potash, Revised,	......	......	11.00	10.00	1.00
Rasin's Phosphate and Potash Fertilizer,	......	......	11.00	10.00	2.00
Rasin's Special Fish Mixture,	0.82	1.00	11.00	10.00	......
Rasin's Special Crop Preparation,	1.65	2.00	11.00	10.00	......
Rasin's Special Fish Guano,	1.65	2.00	12.00	11.00	......
Rasin's Empire Superphosphate,	2.47	3.00	11.00	10.00	......
Rasin's Potato and Vegetable Fertilizer,	3.29	4.00	9.00	8.00	......
Rasin's Potato and Truck Compound,	3.29	4.00	11.00	10.00	......
Rasin's Truck Ammoniated Superphosphate,	4.12	5.00	9.00	8.00	......
Rasin's Jersey Potato Guano,	4.12	5.00	11.00	10.00	......
Wm. Penn Crop Grower,	0.82	1.00	9.00	8.00	1.00
Rasin's United Grain Grower,	0.82	1.00	9.00	8.00	2.00

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
Rasin-Monumental Co., Baltimore, Md.—Continued.					
Rasin's All Crop Guano,	0.82	1.00	9.00	8.00	5.00
Rasin's Empire Guano,	1.65	2.00	9.00	8.00	2.00
Rasin's Royal Fish and Potash Mixture,	1.65	2.00	9.00	8.00	3.00
Rasin's Emergency Royal Fish and Potash Mixture	1.65	2.00	9.50	8.50	1.00
Rasin's Universal Crop Manure,	1.65	2.00	9.00	8.00	5.00
Rasin's Empire Guano Special, Revised,	2.47	3.00	9.00	8.00	2.00
Rasin's Empire Guano Special,	2.47	3.00	9.00	8.00	3.00
Rasin's Potato and Vegetable Guano,	3.29	4.00	9.00	8.00	1.00
Rasin's High Grade Potato and Truck Manure, Revised,	3.29	4.00	9.00	8.00	2.00
Rasin's Champion Potato and Vegetable Manure,	3.29	4.00	9.00	8.00	3.00
Rasin's Potato and Truck Manure,	3.29	4.00	11.00	10.00	1.00
Rasin's Special Potato and Truck Fertilizer,	3.29	4.00	11.00	10.00	2.00
Rasin's Truck and Vegetable Manure,	4.12	5.00	9.00	8.00	1.00
Rasin's Truck and Vegetable Special,	4.12	5.00	9.00	8.00	2.00
Rasin's Electric Truck and Vegetable Manure,	4.12	5.00	9.00	8.00	3.00
Reading Bone Fertilizer Co., Reading, Pa.					
Nitrate of Soda,	15.00	18.00	......	......	......
14% Clear Acid Phosphate,	......	......	15.00	14.00	......
16% Clear Acid Phosphate,	......	......	17.00	16.00	......
Pure Bone Meal,	2.46	3.00	23.00	......	......
Animal Tankage,	5.75	7.00	9.00	......	......
Reading Special Grain and Grass Producer,	0.82	1.00	8.00	7.00	......
Dissolved Animal Matter,	0.82	1.00	11.00	10.00	......
Reading Special Potato and Tobacco Manure,	0.82	1.00	13.00	12.00	......
Reading All Crop Special,	1.64	2.00	11.00	10.00	......
Animal Tankage Mixture,	1.64	2.00	15.00	14.00	......
Reading Prize Winner,	2.46	3.00	10.00	9.00	......
Reading Four and Eight,	3.29	4.00	9.00	8.00	......
High Grade Truck Food,	3.29	4.00	13.00	12.00	......
Reading One Ten and One,	0.82	1.00	11.00	10.00	1.00
Blood Meat and Potash Mixture,	1.64	2.00	9.00	8.00	2.00
Reading Four Eight and Three,	3.29	4.00	9.00	8.00	3.00
Reading Chemical Co., Reading, Pa.					
Reading Clear Acid Phosphate,	......	......	15.00	14.00	......
High Grade Phosphate,	......	......	17.00	16.00	......
Farmers Meat Mixture,	0.82	1.00	9.00	8.00	......
Farmers Favorite,	0.82	1.00	11.00	10.00	......
Reading Soil Builder,	1.64	2.00	11.00	10.00	......
Pennant Winner,	2.46	3.00	11.00	10.00	......
Complete Fertilizer,	0.82	1.00	9.00	8.00	1.00
Old Standard,	1.64	2.00	9.00	8.00	2.00

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
Robert A. Reichard, Allentown, Pa.					
Acid Phosphate,	......	......	15.00	14.00	......
American Eagle Phosphate,	......	......	11.00	10.00	2.00
Steamed Bone Meal,	2.88	3.50	22.00	......	......
Raw Bone Meal,	3.70	4.50	23.00	......	......
Universal Phosphate,	0.82	1.00	11.00	10.00	......
Lehigh Special Phosphate,	1.64	2.00	13.00	12.00	......
Ideal Truck Phosphate,	3.28	4.00	11.00	10.00	......
Farmers' Choice Phosphate,	0.82	1.00	8.00	7.00	1.00
Surpass Phosphate,	1.64	2.00	9.00	8.00	2.00
Special Manure,	3.28	4.00	7.00	6.00	2.00
Ruckman Bros., New Brunswick, N. J.					
Acid Phosphate,	......	......	15.00	14.00	......
Ground Bone,	2.47	3.00	20.00	......	......
Special Grain Grower,	2.47	3.00	12.00	10.00	......
Phosphate and Tankage,	3.29	4.00	12.00	6.00	......
Five and Eight,	4.11	5.00	10.00	8.00	......
Schanck, Hutchinson & Field, Hightstown, N. J.					
S. H. and F. Corn Mixture, 2-8-0,	1.65	2.00	9.00	8.00	......
S. H. and F. Potato and Truck Manure, 4-8-0,	3.29	4.00	9.00	8.00	......
S. H. and F. Potato and Vegetable Compound, 4-10-0,	3.29	4.00	11.00	10.00	......
Special Fish Mixture for Potatoes, 4-6-2,	3.29	4.00	7.00	6.00	2.00
Davison's Fish and Potash Mixture for Potatoes, 4-8-3,	3.29	4.00	9.00	8.00	3.00
Special Fish Mixture for Potatoes and Vegetables, 4-10-2,	3.29	4.00	11.00	10.00	2.00
The Scott Fertilizer Co., Elkton, Md.					
Nitrate of Soda,	15.23	18.50	......	......	......
Scott's Tip Top Soluble Phosphate,	......	......	15.00	14.00	......
Scott's Tip Top Soluble Phosphate,	......	......	17.00	16.00	......
Scott's Soluble Phosphate and Potash,	......	......	14.00	12.00	2.00
Scott's Pure Bone Meal,	2.50	3.00	23.00	......	......
Scott's Ground Raw Bone,	3.70	4.50	21.00	......	......
Ground Tankage,	4.94	6.00	9.16	......	......
Scott's Special Grain Grower,	0.82	1.00	12.00	10.00	......
Scott's Crop Grower,	1.65	2.00	10.00	8.00	......
Scott's Ammoniated Base,	1.65	2.00	14.00	12.00	......
Scott's Ammoniated Superphosphate,	3.30	4.00	12.00	10.00	......
Scott's Pennsylvania Potato Grower,	0.82	1.00	10.00	8.00	2.00
Scott's Sure Growth Superphosphate, 1919,	1.65	2.00	10.00	8.00	1.00
Scott's Victory Brand,	1.65	2.00	10.00	8.00	3.00
Scott's Potato Grower, 1919,	1.65	2.00	12.00	10.00	1.00

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
The Scott Fertilizer Co., Elkton, Md.—Continued.					
Scott's Sure Growth Compound, 1919,	3.30	4.00	12.00	10.00	1.00
Special Mixtures in accordance with ruling of State Chemist.					
Sears, Roebuck & Co., Chicago, Ill.					
Reputation Nitrate Soda,	15.50	18.25	......	......	......
Reputation Acid Phosphate,	......	......	16.50	16.00	......
Reputation Acid Phosphate,	......	......	20.50	20.00	......
Reputation 2-10-0 Mixed Fertilizer,	1.60	2.00	......	10.00	......
Reputation 3-10-0 Mixed Fertilizer,	2.50	3.00	......	10.00	......
Reputation 5-11-0 Mixed Fertilizer,	4.10	5.00	......	11.00	......
Reputation Truck and Garden Fertilizer,	4.10	5.00	12.00	11.00	......
M. L. Shoemaker & Co., Inc., Philadelphia, Pa.					
Pure Raw Bone Meal,	3.30	4.00	20.00	......	......
Swift Sure Guano for Tomatoes, Truck and Corn,	1.65	2.00	11.00	9.00	......
Swift Sure Superphosphate for Tobacco and General Use,	3.30	4.00	12.00	9.00	......
Swift Sure Bone Meal,	5.14	6.25	20.00	10.00	......
Harry L. Sickel, Woodbury, N. J.					
Sickel's Sweet Potato Fertilizer, 2-10-0,	1.65	2.00	10.00	10.00	......
Sickel's Fertilizer for Sweet Potatoes, 2-12-0,	1.65	2.00	12.00	12.00	......
Sickel's Truckers' Favorite, 3-10-0,	2.47	3.00	10.00	10.00	......
Sickel's Good for All Crops Fertilizer, 4-10-0,	3.30	4.00	10.00	10.00	......
Sickel's Asparagus Fertilizer, 5-10-0,	4.12	5.00	10.00	10.00	......
Sickel's Best Sweet Potato Fertilizer, 1-9-3,	0.82	1.00	9.00	9.00	3.00
Sickel's High Grade for Sweet Potatoes, 2-8-2,	1.65	2.00	8.00	8.00	2.00
Sickel's 2-10 with Potash, 2-10-1,	1.65	2.00	10.00	10.00	1.00
Sickel's White Potato Fertilizer, 4-8-1,	3.30	4.00	8.00	8.00	1.00
Sickel's White Potato Special with Potash, 4-8-3,	3.30	4.00	8.00	8.00	3.00
Sickel's Early Crop Fertilizer, 5-8-1,	4.12	5.00	8.00	8.00	1.00
South Jersey Farmers' Exchange, Woodstown, N. J.					
Ground King Crab,	10.25	12.50	......	......	......
Nitrate Soda,	15.00	18.50	......	......	......
Acid Phosphate,	......	......	17.00	16.00	......
E 2% Exchange Sweet Potato,	1.65	2.00	9.00	8.00	......
D Exchange Grain and Grass,	1.65	2.00	11.00	10.00	......
C Exchange General Use,	2.46	3.00	11.00	10.00	......
Steamed Bone,	2.46	3.00	22.00	8.00	......
B Exchange High Grade Potato,	3.29	4.00	11.00	10.00	......
Raw Ground Bone,	3.29	4.00	20.00	5.00	......
A Exchange High Grade Potato and Truck,	4.12	5.00	11.00	10.00	......
F Exchange Special Asparagus,	4.92	6.00	9.00	8.00	......
Special Early Tomato,	5.33	6.50	9.00	8.00	......
Animal Tankage,	5.74	7.00	12.00	6.00	......
Ground Fish Scrap,	9.02	11.00	6.00	2.50	......

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
South Jersey Farmers' Ex., Woodstown, N. J.—Cont.					
E 5% Exchange Special Sweet Potato,	0.82	1.00	9.00	8.00	5.00
B 2% Exchange High Grade White Potato,	3.29	4.00	9.00	8.00	2.00
B 3% Exchange Special White Potato,	3.29	4.00	9.00	8.00	3.00
Standard Guano Co., Baltimore, Md.					
Grange Commercial Store Standard Farmers' Favorite,	2.46	3.00	10.50	10.00	.....
Grange Commercial Store Standard Keystone Brand,	3.28	4.00	10.50	10.00	.....
Grange Commercial Store Standard Royal Gem,	4.10	5.00	10.50	10.00	.....
Grange Commercial Store Standard Royal Crop Grower,	3.28	4.00	8.50	8.00	4.00
Swift & Company, Kearny, N. J.					
Swift's Garden City Phosphate,	.....	.....	14.00	14.00	.....
Swift's High Grade Acid Phosphate,	.....	.....	16.00	16.00	.....
Swift's Degelatinized Bone Fertilizer,	0.82	1.00	30.00	.....	.....
Swift's Steamed Bone Fertilizer,	1.65	2.00	28.00	.....	.....
Swift's Wheat and Rye Grower,	1.65	2.00	8.00	8.00	.....
Swift's Special Corn Grower,	1.65	2.00	10.00	10.00	.....
Swift's Truck and Potato Fertilizer,	3.29	4.00	8.00	8.00	.....
Swift's Special Harrison Formula,	3.29	4.00	10.00	10.00	.....
Swift's Long Island Favorite Fertilizer,	4.11	5.00	10.00	10.00	.....
Mammoth Potato Grower,	4.11	5.00	10.00	10.00	.....
Swift's Special Long Island Fertilizer,	4.94	6.00	8.00	8.00	.....
Swift's Top Dresser Formula, No. 1,	5.76	7.00	8.00	8.00	.....
Swift's Long Island Top Dresser,	8.23	10.00	7.00	7.00	.....
Swift's Reliable Grain Fertilizer,	0.82	1.00	8.00	8.00	1.00
Truck and Vegetable Fertilizer,	1.65	2.00	8.00	8.00	1.00
Swift's Red Steer,	1.65	2.00	8.00	8.00	2.00
Special Potato Fertilizer,	2.47	3.00	8.00	8.00	3.00
N. Y. State Potato Fertilizer,	3.29	4.00	8.00	8.00	2.00
White Potato Fertilizer,	3.29	4.00	8.00	8.00	3.00
Swift's Market Garden Manure,	3.29	4.00	8.00	8.00	3.00
Round Potato Fertilizer,	4.11	5.00	8.00	8.00	4.00
Taylor Brothers, Camden, N. J.					
T. B. Superior Ammoniated Phosphate,	1.65	2.00	10.00	10.00	.....
High Grade Potato Phosphate,	1.65	2.00	10.00	10.00	1.00
The Taylor Provision Co., Trenton, N. J.					
John Taylor's Standard Grain Grower, No. 2,	0.82	1.00	13.00	12.00	.....
John Taylor's P. D. B., Revised,	1.64	2.00	11.00	10.00	.....
John Taylor's High Grade Corn and Truck Manure, Revised, No. 2,	2.46	3.00	11.00	10.00	.....
John Taylor's High Grade Potato and Truck Fertilizer, Revised, No. 2,	3.30	4.00	11.00	10.00	.....
John Taylor's Reliable Potato Manure,	3.30	4.00	9.00	8.00	2.00

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
Tennessee Coal, Iron & Railroad Co., Birmingham, Alabama.					
14% Duplex Basic Phosphate,	......	......	14.00	......	......
Duplex Basic Phosphate,	......	......	18.00	......	......
I. P. Thomas & Son Co., Philadelphia, Pa.					
Ground King Crab,	9.87	12.00	......	......	......
Dried Ground Blood,	14.00	17.00	......	......	......
Nitrate Soda,	15.21	18.50	......	......	......
Sulphate of Ammonia,	20.50	25.00	......	......	......
S. C. Phosphate,	......	......	14.50	14.00	......
16% Acid Phosphate,	......	......	16.50	16.00	......
Potash,	......	......	......	......	28.00
Alkaline Fertilizer,	......	......	10.50	10.00	2.00
Thomas Potash Mixture,	......	......	12.50	12.00	1.00
Raw and Acidulated Bone,	1.65	2.00	17.00	......	......
Pure Ground Bone,	2.46	3.00	23.00	......	......
Pure Ground Animal Bone,	3.70	4.50	23.00	......	......
Bone Tankage,	4.90	6.00	13.00	......	......
Thomas Triumph Manure,	0.82	1.00	10.50	10.00	......
Sweet Potato Substitute,	1.65	2.00	10.50	10.00	......
Thomas' Wheat and Corn Guano,	1.65	2.00	10.50	10.00	......
Farmers' Choice Fertilizer,	2.45	3.00	10.50	10.00	......
Long Island Special, 4-10-0,	3.25	4.00	10.50	10.00	......
Fish Guano,	4.10	5.00	10.50	10.00	......
High Grade Ammoniated Fertilizer,	4.90	6.00	8.50	8.00	......
Crude Fish,	5.75	7.00	4.00	3.00	......
7% Guano,	5.75	7.00	8.50	8.00	......
Superior Superphosphate,	0.82	1.00	7.50	7.00	1.00
Grain Special Fertilizer,	0.82	1.00	8.50	8.00	2.00
I. P. Thomas 1-8-5 Fertilizer,	0.82	1.00	8.50	8.00	5.00
Improved Fertilizer,	0.82	1.00	10.50	10.00	1.00
Victor Potash Fertilizer,	0.82	1.00	12.50	12.00	1.00
Champion Guano,	1.65	2.00	8.50	8.00	1.00
I. P. Thomas 2-8-2 Fertilizer,	1.65	2.00	8.50	8.00	2.00
Tip Top Fertilizer,	2.45	3.00	8.50	8.00	1.00
Truckers' High Grade Manure,	3.25	4.00	8.50	8.00	1.00
I. P. Thomas 4-8-2 Fertilizer,	3.25	4.00	8.50	8.00	2.00
I. P. Thomas 4-8-3 Fertilizer,	3.25	4.00	8.50	8.00	3.00
Special Mixtures in accordance with ruling of State Chemist.					
Trenton Bone Fertilizer Co., Trenton, N. J.					
Tankage,	4.92	6.00	......	......	......
Tankage,	6.56	8.00	......	......	......
Nitrate Soda,	14.80	18.00	......	......	......

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
Trenton Bone Fert. Co., Trenton, N. J.—Cont.					
Acid Phosphate,	......	......	17.00	16.00	......
Trenton Ground Steamed Bone,	2.46	3.00	23.00	......	......
Farmers' Co-Operative Ass'n Ground Steamed Bone	2.46	3.00	23.00	......	......
Trenton Pure Ground Bone,	3.28	4.00	23.00	......	......
Oats Mixture,	0.82	1.00	11.00	10.00	......
Special Grain,	1.64	2.00	10.00	9.00	......
Sweet Potato and Corn,	1.64	2.00	11.00	10.00	......
Farmers' Co-Operative Ass'n, 2-10-0,	1.64	2.00	11.00	10.00	......
Bone and Tankage,	2.05	2.50	9.00	8.00	......
Corn Special,	2.46	3.00	12.00	11.00	......
Farmers' Co-Operative Ass'n, Grain and Grass,	2.46	3.00	12.00	11.00	......
4-8 Potato,	3.28	4.00	9.00	8.00	......
4-10 Potato,	3.28	4.00	11.00	10.00	......
Borden's Fish Mixture,	4.10	5.00	6.00	5.00	......
5-8 Potato,	4.10	5.00	9.00	8.00	......
Truck and Cabbage,	6.56	8.00	9.00	8.00	......
4-8-1 Potato,	3.28	4.00	9.00	8.00	1.00
4-8-2 Potato,	3.28	4.00	9.00	8.00	2.00
4-8-3 Potato,	3.28	4.00	9.00	8.00	3.00
Farmers' Co-Operative Ass'n, 4-8-3 Potato,	3.28	4.00	9.00	8.00	3.00
Farmers' Co-Operative Ass'n, 4-8-5 Potato,	3.28	4.00	9.00	8.00	5.00
4-8-5 Potato,	3.28	4.00	9.00	8.00	5.00
4-10-3 Potato,	3.28	4.00	11.00	10.00	3.00
Special Mixtures in accordance with ruling of State Chemist.					
F. W. Tunnell & Co., Inc., Philadelphia, Pa.					
7% Tankage,	5.77	7.00	......	......	......
1012 Mixture,	......	......	11.00	10.00	1.00
1013 Mixture,	......	......	11.00	10.00	1.00
Pure Ground Bone,	2.46	3.00	23.00	......	......
Crude Fish and Manure,	3.30	4.00	3.00	......	......
7% Fish,	5.77	7.00	7.00	......	......
Wheat Grower,	0.82	1.00	10.00	9.00	......
Grain Manure,	0.82	1.00	13.00	12.00	......
1919 Fish Manure,	1.64	2.00	11.00	10.00	......
1919 Potato and Vegetable Manure,	1.64	2.00	11.00	10.00	......
Raw and Acidulated Animal Compound,	1.64	2.00	15.00	10.00	......
1919 No. 2 Potato and Truck Manure,	2.46	3.00	11.00	10.00	......
Burlington Truck Manure,	3.30	4.00	9.00	8.00	......
1919 No. 1 Potato and Truck Manure,	3.30	4.00	11.00	10.00	......
1919 Lighting Guano,	4.12	5.00	9.00	8.00	......
Long Island Trucker,	4.12	5.00	11.00	10.00	......
1919 Sweet Potato Guano, No. 2,	0.82	1.00	9.00	8.00	4.00

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
F. W. Tunnell & Co., Inc., Philadelphia, Pa.—Cont.					
1919 Sweet Potato Manure,	1.64	2.00	9.00	8.00	2.00
1919 Pride of Jersey,	3.30	4.00	8.00	7.00	2.00
1919 Jersey Potato Manure,	3.30	4.00	9.00	8.00	1.00
Monmouth's Pride Potato Manure,	3.30	4.00	9.00	8.00	2.00
1919 Special Potato Manure,	3.30	4.00	9.00	8.00	3.00
Excelsior Potato Manure,	3.30	4.00	9.00	8.00	4.00
1919 Truck Manure,	4.12	5.00	7.00	6.00	1.00
Superior Truck Grower,	4.12	5.00	9.00	8.00	2.00
Special Mixtures in accordance with ruling of State Chemist.					
The J. E. Tygert Co., Philadelphia, Pa.					
14% Acid Phosphate,	......	......	15.00	14.00	......
Ammoniated Fertilizer A,	0.82	1.00	11.00	10.00	......
Ammoniated Fertilizer AA,	1.65	2.00	11.00	10.00	......
Ammoniated Fertilizer AAA,	2.47	3.00	11.00	10.00	......
Great Advancer Phosphate, 1916,	3.29	4.00	11.00	10.00	......
Tygert's 5-10-0 Fertilizer,	4.11	5.00	11.00	10.00	......
Golden Harvest Phosphate, 1916,	0.82	1.00	9.00	8.00	1.00
Welcome Brand Fertilizer,	0.82	1.00	9.00	8.00	2.00
Quaker Special Fertilizer, 1916,	0.82	1.00	11.00	10.00	1.00
Sweet Potato Guano, 1916,	1.23	1.50	11.00	10.00	1.00
Standard Fertilizer,	1.65	2.00	9.00	8.00	2.00
Vegetable and Corn Fertilizer, 1916,	1.65	2.00	11.00	10.00	1.00
Old Reliable Phosphate, 1916,	2.06	2.50	9.00	8.00	1.00
Special Potato and Tomato Guano, 1916,	2.06	2.50	11.00	10.00	1.00
Paramount Potato and Truck Manure, 1918,	3.29	4.00	9.00	8.00	3.00
Early Truck Guano, 1916,	3.29	4.00	10.00	9.00	1.00
Ten Per Cent. Guano,	8.23	10.00	6.00	5.00	1.00
Union Chemical Works, Inc., North Wales, Pa.					
Nitrate of Soda,	15.58	19.00	......	......	......
Acid Phosphate,	......	......	14.00	14.00	......
Acid Phosphate 16%,	......	......	16.00	16.00	......
Bone Meal,	2.46	3.00	22.00	......	......
Raw Bone Meal,	3.69	4.50	21.00	......	......
Ground Tankage,	4.92	6.00	9.15	......	......
One Eight Mixture,	0.82	1.00	8.00	8.00	......
Two Eight Mixture,	1.64	2.00	8.00	8.00	......
Two Ten Mixture,	1.64	2.00	10.00	10.00	......
Three Ten Mixture,	2.46	3.00	10.00	10.00	......
Corn Grower,	0.82	1.00	8.00	8.00	1.00
Farmers' Favorite,	1.64	2.00	6.00	6.00	2.00
Truck Grower,	1.64	2.00	8.00	8.00	1.00
Potato Manure,	2.46	3.00	6.00	6.00	1.00

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
Virginia-Carolina Chemical Co., New York City.					
Dried Fish,	8.23	10.00	......	......	......
Tankage,	8.23	10.00	......	......	......
Nitrate of Soda,	14.81	18.00	......	......	......
V.-C. C. Co.'s Red Cross 14% Acid Phosphate,	......	......	15.00	14.00	......
V.-C. C. Co.'s High Grade Acid Phosphate,	......	......	17.00	16.00	......
V.-C. C. Co.'s Bone Meal,	2.47	3.00	22.00	......	......
V.-C. C. Co.'s Little Giant Fertilizer (with 2% Potash),	......	......	10.00	9.00	2.00
V.-C. C. Co.'s Giant Phosphate and Potash,	......	......	11.00	10.00	1.00
V.-C. C. Co.'s Universal Fertilizer for All Crops (without Potash),	0.82	1.00	10.00	9.00	......
V.-C. C. Co.'s Ammoniated Bone Phosphate for All Crops,	1.65	2.00	11.00	10.00	......
V.-C. C. Co.'s High Grade Ammoniated Bone Phosphate,	1.65	2.00	13.00	12.00	......
V.-C. C. Co.'s High Grade Corn and Vegetable Compound (without Potash),	2.47	3.00	11.00	10.00	......
V.-C. C. Co.'s Double Owl Brand Potato and Truck Fertilizer (without Potash),	3.29	4.00	11.00	10.00	......
C. & B. XXXX Fish and Potash Potato Manure (without Potash),	3.29	4.00	9.00	8.00	......
V.-C. C. Co.'s 20th Century Potato Manure (without Potash),	4.11	5.00	11.00	10.00	......
V.-C. C. Co.'s Truckers' Mixture (without Potash)	4.94	6.00	9.00	8.00	......
V.-C. C. Co.'s Plow Brand Fertilizer,	0.82	1.00	9.00	8.00	1.00
V.-C. C. Co.'s Universal Fertilizer for All Crops,	0.82	1.00	10.00	9.00	3.00
V.-C. C. Co.'s XXXX Fish and Potash Mixture,	1.65	2.00	9.00	8.00	1.00
V.-C. C. Co.'s Soluble Guano,	1.65	2.00	9.00	8.00	2.00
V.-C. C. Co.'s Owl Brand Potato and Truck Fertilizer (with 3% Potash),	1.65	2.00	9.00	8.00	3.00
V.-C. C. Co.'s High Grade Corn and Vegetable Compound (with 1% Potash),	2.47	3.00	9.00	8.00	1.00
V.-C. C. Co.'s Double Owl Brand Potato and Truck Fertilizer (with 1% Potash),	3.29	4.00	9.00	8.00	1.00
V.-C. C. Co.'s Double Owl Brand Potato and Truck Fertilizer (with 3% Potash),	3.29	4.00	9.00	8.00	3.00
C. & B. XXXX Fish and Potash Manure (with 3% Potash),	3.29	4.00	9.00	8.00	3.00
V.-C. C. Co.'s 20th Century Potato Manure (with 1% Potash),	4.11	5.00	9.00	8.00	1.00
The Van Iderstine Co., Long Island City, N. Y.					
Van Iderstine's Pure Ground Bone,	2.00	2.43	27.00	......	......

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
The Emil Wahl Mfg. Co., Philadelphia, Pa.					
Emil Wahl Mfg. Co.'s Warranted Pure Philadelphia Button Bone Meal,	3.75	4.50	25.00	......	......
J. A. Wenderoth, Camden, N. J.					
Ground Steamed Bone,	2.46	3.00	20.00	......	......
The West Jersey Marl & Transportation Co., Woodbury, N. J.					
Tankage 6%,	4.94	6.00	......	......	......
Tankage 7%,	5.75	7.00	......	......	......
Tankage 8%,	6.58	8.00	......	......	......
Nitrate Soda,	15.23	18.00	......	......	......
Acid Phosphate (14%),	......	......	14.00	14.00	......
Acid Phosphate (16%),	......	......	16.00	16.00	......
Fine Bone Meal,	2.47	3.00	22.00	......	......
Pure Bone Meal, Revised, 1919,	3.30	4.00	18.30	......	......
Pure Bone Flour, Revised, 1919,	3.30	4.00	18.30	......	......
Pure Ground Bone,	3.30	4.00	18.30	......	......
Dry Ground Fish,	8.23	10.00	6.85	......	......
Brand 2-10-0,	1.65	2.00	10.00	10.00	......
Dissolved Bone,	2.05	2.50	14.00	14.00	......
Brand 3-10-0,	2.47	3.00	10.00	10.00	......
Brand 4-10-0,	3.30	4.00	10.00	10.00	......
Brand 5-10-0,	4.12	5.00	10.00	10.00	......
Special Sweet Potato Manure, Revised, 1919,	0.82	1.00	9.00	9.00	3.00
Tomato and Potato Manure, Revised, 1919,	1.65	2.00	8.00	8.00	2.00
Brand 2-10-1,	1.65	2.00	10.00	10.00	1.00
All-Crop Mixture, Revised, 1919,	1.65	2.00	10.00	10.00	1.00
High Grade Truck Manure,	3.28	4.00	8.00	8.00	1.00
Early Potato Manure,	3.28	4.00	8.00	8.00	3.00
Brand 4-10-3,	3.28	4.00	10.00	10.00	3.00
Asparagus Manure,	4.10	5.00	8.00	8.00	1.00
W. E. Whann Co., Philadelphia, Pa.					
Whann's Chester Valley Liberty Brand Superphosphate A,	0.82	1.00	11.00	10.00	......
Whann's Chester Valley XXX Ammoniated Fertilizer,	1.23	1.50	11.00	10.00	......
Whann's Chester Valley Liberty Brand Superphosphate AA,	1.65	2.00	11.00	10.00	......
Whann's Chester Valley Liberty Brand Superphosphate AAA,	2.47	3.00	11.00	10.00	......
Whann's Chester Valley Liberty Brand Superphosphate AAAA,	3.29	4.00	11.00	10.00	......
Whann's Chester Valley Truck Manure,	4.11	5.00	9.00	8.00	......

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
W. E. Whann Co., Philadelphia, Pa.—Continued.					
Whann's Chester Valley Special Ammoniated Superphosphate, 1916,	0.82	1.00	9.00	8.00	1.00
Whann's Chester Valley General Crop,	0.82	1.00	9.00	8.00	2.00
Whann's Chester Valley Available Ammoniated Superphosphate, 1916,	0.82	1.00	11.00	10.00	1.00
Whann's Chester Valley No. 2 Ammoniated Superphosphate, 1916,	1.23	1.50	11.00	10.00	1.00
Whann's Chester Valley John Whann Son's Sweet Potato Fertilizer, 1916,	1.23	1.50	11.00	10.00	1.00
Whann's Chester Valley Standard Fertilizer,	1.65	2.00	9.00	8.00	2.00
Whann s Chester Valley Fish and Potash Fertilizer, 1916,	1.65	2.00	11.00	10.00	1.00
Whann's Chester Valley Potato and Truck Special, 1916,	2.06	2.50	9.00	8.00	1.00
Whann's Chester Valley Special Potato and Truck Fertilizer, 1916,	2.47	3.00	10.00	9.00	1.00
Whann's Chester Valley High Grade Truck Manure, 1916,	3.29	4.00	10.00	9.00	1.00
Whann's Chester Valley Potash Mixture for Potatoes and Truck,	3.29	4.00	11.00	10.00	3.00
Whann's Chester Valley Cabbage and Cauliflower Manure, 1916,	4.11	5.00	9.00	8.00	1.00
William Wilde, Vineland, N. J.					
Nitrate Soda,	15.00	18.20	......	......	......
Acid Phosphate,	......	......	16.00	16.00	......
Steamed Bone,	2.47	3.00	22.00	......	......
Ground Bone,	3.65	4.50	22.00	......	......
Tankage,	4.90	6.00	13.00	......	......
Tankage,	6.90	8.50	8.00	......	......
Common Sweet Potato,	2.47	3.00	10.00	10.00	......
Truck Fertilizer,	3.25	4.00	10.00	10.00	......
Strawberry Dressing,	3.25	4.00	10.00	10.00	......
High Grade Truck,	4.10	5.00	10.00	10.00	.....
2% Sweet Potato Fertilizer,	1.65	2.00	8.00	8.00	2.00
3% Sweet Potato Fertilizer,	1.65	2.00	8.00	8.00	3.00
Best White Potato,	3.25	4.00	8.00	8.00	3.00
S. Winterbottom, Egg Harbor City, N. J.					
Pure Bone Dust,	3.80	4.61	26.30	......	......
Witherbee, Sherman & Co., Port Henry, N. Y.					
Barium-Phosphate,	......	......	16.00	......	......
Woodward & Dickerson, Philadelphia, Pa.					
Vegetable Tankage,	3.90	4.75	......	......	......
King Crab Meal,	8.23	10.00	......	......	......

Brands Registered for the Fiscal Year Ending October 31, 1919

	Guaranteed Minimum Analysis				
	Nitrogen	Nitrogen Equivalent to Ammonia	Total Phosphoric Acid	Available Phosphoric Acid	Potash
	%	%	%	%	%
Woodward & Dickerson, Phila., Pa.—Cont.					
King Crab Meal,	9.85	12.00	......	......	......
Hoof and Horn Flour,	14.40	17.50	......	......	......
Nitrate of Soda,	14.82	18.00	......	......	......
Sulphate of Ammonia,	20.18	24.50	......	......	......
Acid Phosphate,	......	......	15.00	14.00	......
Acid Phosphate,	......	......	15.50	15.00	......
Acid Phosphate,	......	......	16.50	16.00	......
Ground Bone,	1.65	2.00	25.00	......	......
Ground Bone,	2.47	3.00	20.60	......	......
Ground Bone,	3.29	4.00	20.50	......	......
Unground Bone Tankage,	3.80	4.60	20.00	......	......
Screened Tankage,	7.41	9.00	7.00	......	......

PRES[illegible]